QUICK REVISION PHYSICS

PHYSICS

O'LEVEL STUDENTS

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Excel in Physics

New Edition with Physics syllabus

QUICK Revision Physics for S1-S4 has been uniquely designed to assist students to quickly revise physics topics taught at these levels right from paper one 5351 to 5352 without any handles.

It's essential for both teachers and students preparing for UCE UNEB physics.

It's simple, clear and precise and all expected questions to be set in every examination have been provided in this question bank and are up to both KCSE and UNEB standard.

Sample papers have been put to aid quick revision for both paper one and paper two, and a sample marking guide has been provided for both students and the teachers.

For any inquiries you can contact me on the addresses provided above for further assistance and guidance.

Passionate quotes

- If you can't explain it, simply you didn't understand it.
- Experience is the teacher of all things.
- Always keep an open mind and a compassionate heart.
- Be happy. It's one way of being wise.

SCOPE & DEPTH of Physics Syllabus

The syllabus has been divided into seven broad areas, namely:
1. Mechanics and Properties of Matter
2. Heat
3. Light Optics
4. Waves
5. Electricity
6. Magnetism
7. Modern Physics
8. Sample specimen papers; with and without solutions

SENIOR I

Topic	**Sub-topics**	
1. Mechanics and Properties of Matter	Measurements	18
	Density	
	States of matter	
	Introduction to forces	
2. Heat	Thermometry	09
	Heat transfer	
3. Light	Rectilinear propagation of light	08
	Reflection of light at plane surfaces	
4. Electricity	Introduction to Electricity (Part I)	09

5. Magnetism	Magnets	09

SENIOR II

TOPIC	**SUB-TOPICS**	
1. Mechanics and properties of Matter	Turning effect of forces and centre of gravity	09
	Machines	
	Work, energy and power	
	Pressure	
	Properties of Matter	
2. Light	Reflection of light at curved surfaces	09
3. Waves	Wave motion (Progressive waves)	04
	Properties of waves	
	Stationary waves	
	Sound waves	
	Properties of sound waves	
4. Electricity	Introduction to Electricity (Part 2)	06
5. Magnetism	Magnetic effect of an electric current	06

SENIOR III

TOPIC	**SUB-TOPICS**	
1. Mechanics and Properties of Matter	Motion	11
	Vector and	

	scalar quantities		
	Linear momentum		
	Newton's Laws of motion		
	Friction between solids		
	Mechanical energy		
	Archimedes principle		
	Fluid flow		
	Properties of materials under stress and structures		
2. Heat	Quantity of heat		08
	Latent heat		
	Vapours		
	Expansion of solids and liquids		
3. Light	Refraction of light at a plan surface		10
	Dispersion of light		
	Lenses and optical		

	instruments	
4. Electricity	Electrostatics	11

SENIOR IV

TOPIC	**SUB-TOPICS**	
1. Heat	Gas Laws	15
2. Electricity	Potential difference electromotive force	03
	Electric cells	
	Electric current, resistance and ohm's law	
	Electric circuits	
	Ammeters, voltmeters and galvanometers	
	Electrical energy	
	Domestic electricity	
	Distribution of electrical energy	
3. Magnetism	Principle of the electric motor	05
	Electromagnetic induction	
4. Modern Physics	Electrons	06

	X-rays	
	Atomic and nuclear structures	
	Radioactivity	

Mr. Yasson has taught physics for a number of years in various schools as well and can be reached for any assistance.

GETTING PREPARED IN AN EXAMINATION ROOM

Before starting

1) Do not enter the exam room at the last possible moment. Early candidates may be able to choose their seats and there is much to do before the exam starts.

2) Do not sit an examination when unwell without informing the Invigilator before the start of the paper.

3) Do not drink (alcohol) before an exam or eat too much or too little.

4) Do use the “waiting” time sensibly before the “official start.”

5) Write your name and examinations details onto all the answer

books/paper. Study the front of the exam paper for the expected rubric and any constants and date; also the apparatus can be studied carefully.

6) Do not sit an examination without a convenient means of keeping track of the time that is elapsing.

After starting the Examination

(a) Read the rubric of the examination paper and make sure all the instructions given are understood in first 15minutes and use at least **27minutes** for each of the five numbers

(b) Read through all questions on the paper during the first 15 minutes and decide which of either question to be done in addition to the compulsory question either or not.

(c) Reading through the whole question before starting will help in planning what one is going to do. A few minutes spent thinking about the best way to arrange them.

(d) The question will clearly indicate what amount of 'writing up' is required.

Order of Contents

TOPICAL QUESTIONS.

1. MECHANICS AND PROPERTIES OF MATTER

1(a) Define the following terms:

(i) Force

(ii) Mass

(iii) Weight

(iv) Vector and scalar quantity

(b)(i) Distinguish between cohesive and adhesive forces

(ii) Some mercury and water were poured each into a glass tube. Sketch and explain the shapes of the meniscus

(c)(i)What is meant by the term surface tension?

(ii) Describe an experiment to investigate surface tension?

(iii) State any four factors that affect surface tension of a liquid

(d) Explain why match stick rubbed at one end with soap a when placed on the surface of water starts moving in one direction.

(e) Explain, with the aid of diagram what happens when three glass tubes of different diameter are dipped in water.

(f) What would happen if the same glass tubes in (e) above were replaced with mercury instead of water? Explain.

2(a) (i) Distinguish between mass and weight

(ii) What is meant by the following terms and give examples of each: **scalar quantity,** and **vector quantity**

(b)(i) Define the unit of force?

(ii) The weight of an object on the earth's surface is 400N. Calculate it's mass and hence its weight on the moon. (Assume on earth $g=10Nkg^{-1}$ and moon, gravity is a quarter on earth)

(c)(i) State two reasons why weight of a body varies from place to place on the earth's surface.

(ii) The weight of a stone in kasese was found to be different from the weight of the same stone on top of mount Rwenzori. Explain.

(d)(i) State three effects of force on a body

(ii) State any three disadvantages of frictional forces

(e) Explain why large mercury drops form oval balls on glass slide

3(a) Explain the meaning of the terms:

(i) Crystal

(ii) Cleavage

(b) Describe the process of growing crystal(s) e.g. copper sulphate.

(c) Briefly explain the cleavage of crystals

(d) Why is Brownian motion only exhibited by small particles?

(e) The kinetic theory suggests that molecules of a gas or a liquid are in a continuous random motion. Explain in terms of kinetic theory why a gas exerts pressure, which increases when the gas is compressed into small particles.

4(a) What is meant by the term Brownian motion?

(b)(i) State the kinetic theory of matter.

(ii) Explain the Brownian motion using the kinetic theory of matter.

(c) Describe an experiment that demonstrates the existence of invisible randomly moving particles in matter.

(d) Explain the effect of temperature on particle motion in matter

(e) In the Brownian motion experiment for gases to investigate the behavior of smoke particles, smoke and light were used in a smoke cell. Explain:

(i) Why is light shone into the cell?

(ii) Why are smoke particles preferred in this experiment?

(iii) State the expected observations?

(iv) Explain the above observations.

(f) Using the kinetic theory, give an explanation for dust particles floating in still air appear to jog about.

5(a) Define the term diffusion?

(b) Explain how diffusion occurs in :

(i) liquids

(ii) gases

(c) State the factors affecting the rate of diffusion

(d) A drop of liquid bromine is introduced into the bottom of an air filled gas jar and the jar is covered with a glass plate

(i) Describe and explain what would then be seen

(ii) Describe and explain what would happen if bromine gas is introduced into the bottom of an evacuated glass tube.

e) Describe an experiment to estimate the thickness of an oil molecule.

State all the assumptions made in this experiment

6) a) Explain the meaning of the term surface tension.

b) A steel needle floats when placed horizontally on the surface of clean water.

i) What is the name of the force that supports the needle?

ii) If a drop of liquid soap is added to the surface of the water, the needle sinks. Explain this.

iii) Is the force named in (i) above responsible for the floating of a cork on water?

c) Describe an experiment to show the existence of surface tension.

d) State the factors that affect the surface tension of a liquid.

7(a) Define capillarity.

b) In terms of adhesion and cohesion, explain the phenomenon of capillarity.

c) State any two applications of capillarity

d) State and explain the factors which affect capillarity

e) State the reason why water spilled on glass surface wets he surface

f) When a pin is dropped onto the surface of water, it does not float but when it is carefully placed on the water surface, it floats. Explain this observation,

8(a) Explain the meaning of the term elasticity.

b) State Hooke's law and its limitations

c) Describe an experiment to investigate the behavior of a spiral

spring under stress.

d) i) What is meant by the spring constant?

ii) Explain the following terms:

1. Elastic deformation,

2. Plastic deformation

iii) Illustrate using a suitable sketch graph the elastic and

plastic deformation regions for a wire undergoing stretching.

e) State the factors that affect the spring constant of a material.

f) A spring with its upper end fixed, hangs vertically a long-side a meter rule. The lower end of the spring gave the following readings when various masses were suspended from it.

Mass (kg)	0	0.02	0.04	0.06	0.08	1.00
Readings (cm)	11	12.1	12.9	13.9	15.1	16.1

i) Plot a graph of applied force against extension

ii) From the graph, determine the spring constant.

g) Write brief notes on the following.

i) Ductile material (ductility)

ii) Brittleness

iii) Stiffness.

iv) Strength of material

v) Tensile stress and Tensile strain

Name two examples of each of the above materials.

9(a)i) What is a beam?

ii) Draw a stress line for a beam under tensile and compressive stress.

b)i) Define a notch and notch effect?

ii) State the ways in which to prevent formation and damage due to notches?

iii) With the aid of a diagram, explain how cracking due to a notch can be stopped.

c) i) What is concrete? How is concrete made?

ii) State the properties of concrete which make it a suitable building material.

iii) Concrete is strong under compression but weaker under tension. Explain briefly how concrete can be improved so that it can withstand tensional forces if it were to be used to make a second floor of a building.

iv) State any two ways in which concrete may be made stronger.

d)i) Define reinforced concrete?

ii) State any three ways in which concrete may be reinforced.

iii) Explain briefly how concrete may be improved so as to withstand tensional forces.

10(a) State 5 advantages of glass as a building material.

b) Give reasons why hollow metal structures are preferred to solid structures for making a bicycle frame.

c) In the construction for bridges or large structures, hollow tubes of strong metals are used instead of solid ones. What advantages do such structures have?

d) Define the following terms:

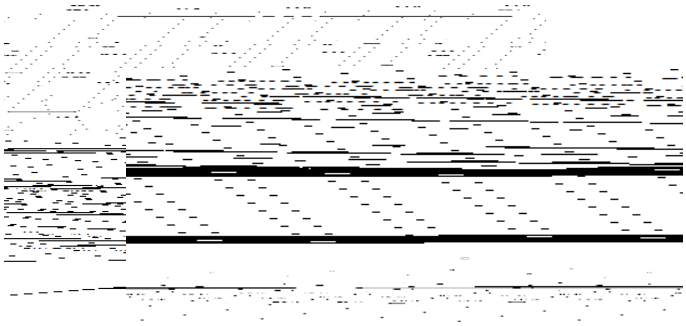
i) Strut ii) Tie

e)i) What are the applications of struts and ties?

ii) The figure in **(A)** below shows the structure of a bridge.

Name the girders that are in tension and those in compression.

f) Identify one strut and one tie for a structure fixed on a wall in **(B)** so that it stands in a vertical plane and supports a load as indicated.



(A) **(B)**

2. TURNING EFFECT OF FORCES, CENTRE OF GRAVITY, WORK, ENERGY, POWER AND MACHINES.

1. **a** (i) Define *center of gravity*.

(ii) State two factors which affect the stability of a body.

b) Describe an experiment to determine the Centre of gravity of an non uniform lamina.

c) Explain why buses should carry heavy luggage in compartment situated in the lower parts instead of the roof racks.

d) (i) What is meant by *stability of a body*?

(ii) State and explain the state of equilibrium with illustrations.

iii) State any 3 application of stability.

e) A bottle containing soda stands on a bench.

As the temperature of surrounding rises the temperature of the soda in bottle rises. Explain the effect on the stability of the bottle.

2(a) i) Define *moment of a force* and state its units

(ii) State the principle of moments.

iii) State three factors which affect the moment of a force.

b) What are the necessary conditions for a body to be in equilibrium?

c)i) The handle of door is near its outside edge. Explain why it is so?

ii) Describe an experiment to determine the weight of a beam using the principle of moment.

d)i) Using a known mass M, explain how the principle of moments is used to determine the mass of unknown body.

ii) State any practical application of turning effect of forces.

3)a) Define the term:

i) Couple ii) Torque

b) State the effect of a couple.

c) State the relationship between the position of the Centre of gravity and stability.

d) A uniform rod 120cm long has weight 2N and 0.2N hanging from its ends and their balances when supported at a point 20cm from the larger weight. What is the weight of the rod?

d) i) What is *a simple machine*?

ii) With example explain the three classes of lever.

e) Explain what you understand by each of those terms as applied to machines.

i) Mechanical advantage.

ii) Velocity ratio.

iii) Efficiency.

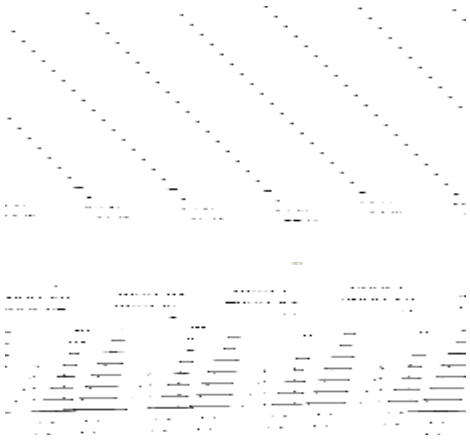
How are these terms related?

f) Explain why the efficiency of a practical machine is always less

than 100%. Suggest any ways of improving efficiency.

Suggest ways (method) of improving efficiency.

g)i) In the gear system sketched in the figure below N_1 and N_2 are the number of teeth on the wheels of the shaft radii are 0.4m and 0.2m respectively and the efficiency is 30% .



Find :)(i) the V.R

(ii) The load that can be raised by an effort of 20N.

4(a) Explain how the *mechanical advantage, velocity ratio* and *efficiency*

of each of the following is determined.

(i) Wheel and axle.

(ii) Pulley system.

(iii) Gears.

(iv) Screws and inclined planes

b)(i) What is ***pitch?***

(ii) Illustrate using a suitable diagram, how a velocity ratio of 4 can be obtained with a pulley system.

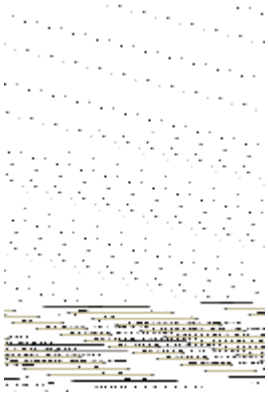
c) Describe how mechanical advantage and efficiency of a block and tackle pulley system is determined experimentally

d) .By means of a lever, an effort of 50N moves a load of 200N through 3m. if the effort moves through a distance of 16m,calculate:

i) the mechanical advantage

ii) the efficiency of the lever.

e) A single movable pulley was used to lift a load of 4N as shown in the figure.



i) Calculate the effort needed to raise it, hence find the mechanical advantage of the pulley.

ii) Give three practical examples where pulley systems are used.

5(a) The readings obtained in a such experiment when a block and tackle pulley system which has two pulley wheels in each set are as follows. W is the load attached to the lower pulley block.

Load(N)	0.2	0.6	1.0	1.5	2.0	2.4	3.0	4.0	5.0
Efficiency (%)	20	48	60	68	73	76	80	82	82

Plot a graph of efficiency (y-axis) against load (x-axis)

i) Comment on the shape of the graph as regards the changes in the efficiency with the increase in the load.

ii) Read from the graph the efficiency for W=1.2N and hence, calculate the effort required to lift this load.

iii) Is the value of load W recorded really the total weight lifted?

b) Over 95% of our *primary sources of energy are non-renewable fossil fuels.*

i) What is meant by a **primary source of energy?**

ii) Name three fossil fuels and state why they considered non renewable

iii) Which of the following sources of energy are non-renewable?

Coal, wind, natural gas, oil, water, waves, radiant heat, nucleus, electricity.

c)i) State the energy changes/conversion in a solar cell and state its practical uses.

ii) Why are solar cells not likely to be used to generate electricity in the near future?

6)a) Define :

i) Renewable energy sources

ii) Non-renewable energy sources

Give two examples of each of the above sources.

b) State what energy changes occur in each of the following cases:

i) A bullet fired from a rifle

ii) A battery used to light the lamp in a torch

c) i) Define the *unit of work*.

ii) A boy of mass 40kg climbs up a stair case of a plane which has steps of 12cm each. If the total number of steps are 50.Calculate the work done by the boy, and hence the power developed if he can run up the same staircase in 12seconds.

d) State and describe the different forms of energy in our

environment.

e) Explain what an energy transformation is, and state some of the examples of it.

7)a)i) State the *law of conservation of energy.*

ii) Name at-least two examples where this law is applicable in real life.

b) i) Define the terms force and power.

ii) An electric water pump raises 250kg of water to the surface from 100cm below ground level in 50 seconds.

Calculate the work done by the pump in that time and the power output of the pump.

c) Distinguish between potential and kinetic energy.

d) An object is released from rest at a height of 20m above the ground.

i) Describe the energy changes which take place.

ii) Calculate the speed with which the object hits the ground.

e) Explain the energy transformation involved in the swinging pendulum bob.

f) A bullet of mass 20g is fired into a block of wood of mass 400g lying on a smooth horizontal surface. If the bullet and the wood move together with a speed of $20ms^{-1}$. Calculate

i) The speed with which the bullet hits the wood.

ii) The kinetic energy lost.

8(a)i) Define *a watt.*

b) In a dam $2.0x10^3$kg of water falls every second through a height of 20m to operate an electric generator

i) Calculate the power input to the generator

ii) State the energy changes which take place.

c) Explain why nail rubbed with oil penetrates timber easily when hammered than a dry nail.

d) i) Describe how a four stroke petrol engine works.

ii) Explain the energy changes / transformations involved in a four stroke engine.

iii) Distinguish between a petrol engine and a diesel engine.

e) A crate of mass 90kg is pushed with a force of 320N along the plane AB to the platform.

i) Calculate the useful work done

ii) How much work is done in pushing the object from the ground level to the platform along AB?

iii) Calculate the magnitude of the force causing the wastage.

9(a)i) Define the terms *potential and kinetic energy.*

ii) State four instances which under energy changes from potential to kinetic and vice versa

iii) State the principle of energy conservation, and illustrate it using a swinging pendulum bob

b) A freely falling body starting from rest falls 5m during the first second and acquires a velocity of $10ms^{-1}$.

i) If the body has a mass of 15kg, what is its kinetic energy at the end of three first second?

ii) What work does it do to raise the body 5m to its previous position?

iii) Explain the relationship between (i) and (ii).

c) i) What is meant by *mechanical energy*?

ii) A ball is dropped from height of 5m from the ground. On hitting the ground it bounces to a height of 8m. Explain this observation.

d)i) Define the *newton and the joule.*

ii) Explain the meaning of *kilowatt*.

3. FLUIDS AND PRESSURE

1(a) State:

(i) Archimedes' principle

(ii) The law of flotation

(b)(i) Describe an experiment to verify law of floatation.

(ii) Give two examples where the law of flotation is applied.

c)(i) Define *density.*

ii) A piece of glass weighs 0.5N in air and 0.3N in water .Find its density.

d)i) Explain the principle of operation of a hydrometer.

ii) What is meant by *up thrust?*

iii) Describe how Archimedes' principle can be verified in the laboratory.

e)A glass block weighs 25N in air. When wholly immersed in water the block weighs 15N. Calculate:

i) the up thrust on the block

ii) the density of the glass in kgm^{-3}

f)i) What is meant by *relative density?*

ii) A solid of volume $10^{-4}m^3$ floats in water of density 10^3kgm^{-3}, with a third of its volume submerged. Find the mass of the solid.

iii) If the solid in (ii) above floats in another liquid with four-fifth of its volume submerged. What is the density of the liquid?

2(a) i) Define the term *fluid.*

ii) State the assumptions on which fluids depend.

b) Define the following terms:

i) Streamlines

ii) Streamline flow

iii) Turbulence .

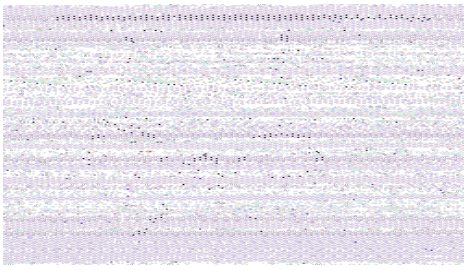
c) Describe an experiment to demonstrate streamline flow and turbulence flow.

d) Mention and explain the relationship between pressure and velocity.

f) Illustrate using a diagram, the forces acting on an object falling in a fluid.

g) Explain why resultant forces on a sky diver changes as his speed changes.

h) Explain what happens when air is blown between two inflated balloons tied on a ceiling as shown.

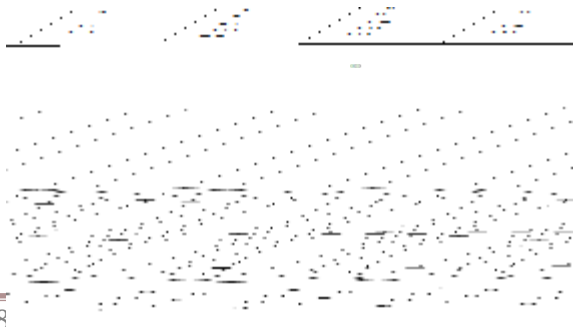


3(a) Define *terminal velocity.*

b) How does terminal velocity come about?

c) Draw a velocity –time and displacement –time graphs to illustrate terminal velocity.

d) A girl blew air along the horizontal below the paper as shown in the figure above. State and explain what would be observed.



e) i) Describe an experiment to verify

Archimedes' principle.

ii) An object of density $1.2gcm^{-3}$ is weighed in air and then completely immersed in water in a measuring cylinder ,the level of water in the cylinder rises from 30cc to 90cc. determine

i) The volume of the object

ii) The weight of the object in air

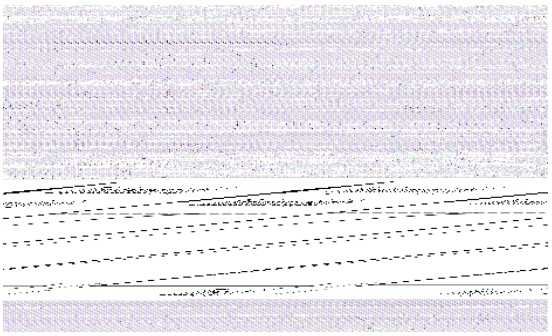
iii) The upthrust on the object

iv) Its apparent weight.

4(a) State the *law of floatation,* and explain how it can be used to determine the density of a liquid.

b) Describe an experiment to determine how the relative density of a liquid can be found using upthrust and principle of moments.

c) The figure shows a uniform plank 1m long balanced by suspending it at the centre of gravity from a string. The 4N weight on one side balances the solid M of volume 80cc which lies immersed in a beaker of water on the opposite side.Calculate (i) the apparent weight of M



(ii) the upthrust on M.

(iii) The beaker of water is then removed and while keeping the weight of 4N constantly at 41.0cm, the position of solid N is adjusted to obtain balance condition again. Determine the new position of M.

(d)(i) Explain what happens when a balloon is inflated with air , and then released.

(ii) Explain why ships float on water surface yet they are made of heavy metals.i.e steel and iron.

(e) In an experiment, the diameter of oil patch was measured to be 200mm for an oil drop of radius 0.25mm.

(i) Determine the diameter of the molecule of the oil.

(ii) Describe one method of determining the diameter of the oil drop

(iii) State why this is an estimate.

5(a) Explain the following terms:

(i) Upthrust

(ii) An aero foil

(iii) A pascal

b)(i) Explain what happens when a skydiver jumps from a high speeding aircraft.

ii) State the factors that affect terminal velocity.

c) Describe an experiment to determine terminal velocity of a viscous fluid.

d) Explain why roofs of houses are blown off when strong wind passes over the houses.

e) Explain why a swimmer would float on fresh water taking a deep breath without exhaling.

f)i) Distinguish between *density and relative density*, giving their SI units.

ii) A ship of mass 1300tonnes floats on sea water. What volume of sea water is displaced?

iii) Suppose it sails from sea water to fresh water, what cargo must be removed so that the same volume of water is displaced?

(Density of sea water=1.025gcm^{-3})

6(a) Define *pressure* and state its units

b) State the factors that affect pressure in solids

c) A brick of mass 3kg measures 6cmby4cmby3cm.

i) What is the greatest pressure it can exert when placed on a flat surface?

ii) What is the least pressure it can exert?

d) Explain the following observations:

i) It is easier to be pierced by a needle than a blunt piece of wood

ii) A hippopotamus does not sink in mud / swampy ground yet a man does sink when he walks on it.

iii) The high heels of shoes can easily dig in the ground as they walk.

iv) Foundations of buildings / Dams have wide bases than the top.

e) James while he was sewing accidently sews his hand, and at the same time, Peter stepped on a nail which was stuck in the ground as he walked. Explain who felt much pain and why it so.

f) Calculate the pressure exerted on the ground by a box of mass 10kg when corresponding area of contact is 2 meter squared.

7(a) Define *pressure in fluids* and state its units

b) Explain the existence of pressure in a fluid.

c) State the factors affecting pressure in fluids.

d) Describe an experiment to illustrate how pressure in fluids varies with

(i) Depth

(ii) Density

e) Derive the expression p =hρg and describe how it is used to compare densities of liquids.

f) Why do heavy trucks have more wheels than other vehicles?

g) Explain why a liquid and not a gas is used as a hydraulic brake fluid.

h) Explain why it is dangerous for a diver to stay for a long time under deep water.

8(a) i) Define *a pascal.*

ii) Describe an experiment to demonstrate pascal's principle.

b) Describe any experiment that the pressure at any given point in a liquid is the same in all directions.

c) Describe any two experiments which show that air exerts a considerable pressure.

d) **Either**. With the aid of a labelled diagram, explain how to measure the excess pressure in Pa, of the laboratory gas supply using a manometer.

Or. Describe how a manometer is used to measure gas pressure.

e) Explain the principle used in the operation of hydraulic devices.

9(a) State the *principle of transmission of pressure in a fluid*.

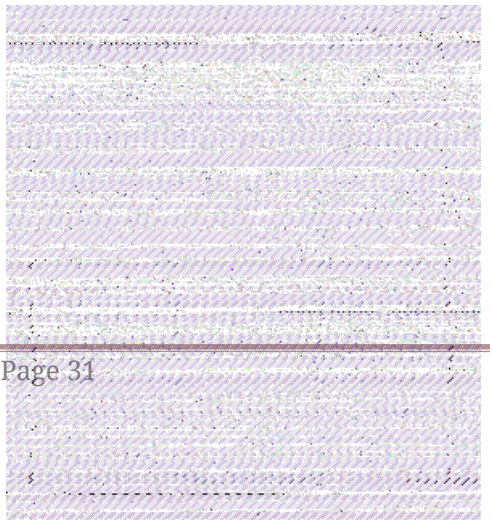
b) Give one practical example where the principle is applied and give a brief explanation of how it works.

c) Why is it necessary:

i) to provide commercial vehicles meant to carry heavy loads with wide double tyres?

ii) to provide tractors with wide hind tyres?

d) State the reason why it may not be possible to suck a liquid into your mouth using a drink straw on the surface of the moon.



e) With aid of a labelled diagram, illustrate the transmission of pressure in a fluid.

f) A manometer contains two liquids X and Y of densities 1000kgm^{-3} and 800kgm^{-3} respectively.

(i) Which point in limb B is at the same pressure as C?

(ii) Calculate the pressure at D due to the liquids.

(iii) Determine the height h.

10(a) What is meant by *atmospheric pressure?*

b) Describe an experiment that shows the existence of atmospheric pressure.

c) State any three applications of atmospheric pressure.

d) Describe how a simple mercury barometer is set up.

e) With the aid of a well labeled diagram, explain how the following works.

i) Force pump ii) Lift pump iii) Rubber sucker

f) Explain the dependence of atmospheric pressure on altitude.

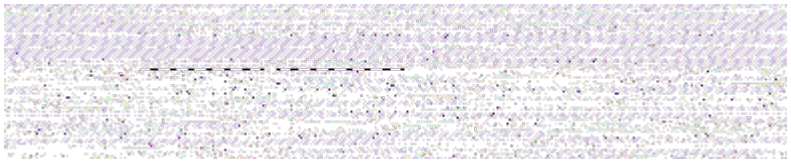
g) i) Calculate the value of atmospheric pressure in pascals at a place where barometer stands at 76cmHg.

(Density of mercury =13600kgm^{-3},g=10Nkg^{-1})

ii) The height of mercury in a barometer that was on a boat on the surface of Lake Victoria was 70cm. calculate the total pressure in Nm^{-2} acting on a fish 50cm below the water.

(Density of mercury =13600kgm^{-3}, and sea water=1020kgm^{-3})

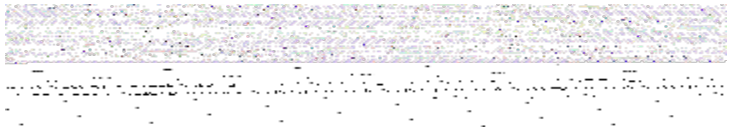
11(a) The cover of a ball point pen has a small hole as shown.



Explain its function.

b) When you carry a heavy load on your bare head, you find it pain full but when you put a ring of cloth on your head and then place the heavy load, you find it more comfortable. Explain.

c) Two microscopic glass slides are pressed together with water film in between them as shown in the figure.



Explain why it is very difficult to pull the slides apart.

d) Explain how a syringe draws water from a beaker.

e) Explain why when pumping up a tyre, the more you pump in air the harder it becomes to pump.

f)(i) With the aid of a diagram, explain the working of a simple mercury barometer.

ii) Explain the sucking of a liquid through a drinking straw.

g) a water tank of rectangular base 3mlong,2m wide, and 1m high is full of salty water of density $1.02gcm^{-3}$.(Neglecting the weight of air above the water.) Calculate the:

i) Force at the bottom of the tank

ii) Pressure at the bottom of the tank

iii) Force on the smaller vertical side of the tank.

h) Explain why atmospheric pressure decrease with increase in

altitude.

i) A barometer reads 76cmHg and 73.8cmHg at the bottom and top of a mountain respectively. If the density of air is 1.25kgm^{-3} and that of mercury is 13600kgm^{-3}, find the height of the mountain.

12(a)i) Define *air pressure.*

ii) Describe any two simple experiments which show that air exerts a considerable pressure

b) Describe a simple experiment to show that pressure at a given point in a liquid is the same in all directions.

c) Explain the principle of operation of siphon.

d) i) Define *relative density.*

ii) Describe with a sketch, how you would set up Hare's apparatus for measuring relative density for a liquid, and show how the result is calculated.

e) Describe an experiment to show that pressure in fluids depends on the density of the liquid.

f) Explain the principle of operation of:

i*) Hydraulic press and hydraulic car brake*

ii) A simple barometer

iii) The manometer

iv) Drinking straw and a syringe

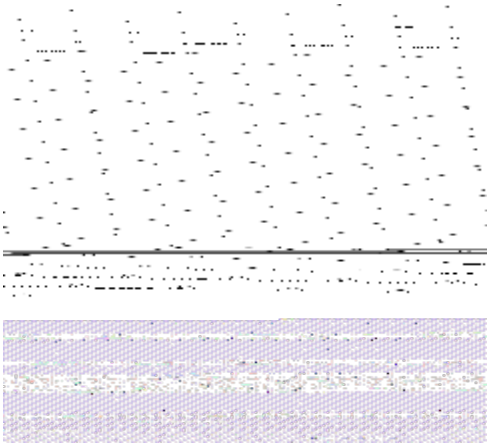
g) Explain why water is not used as

i) a barometric liquid ,

ii) a hydraulic liquid in hydraulic machines.

h) Explain why brakes of a vehicle fail when air enters in the brake pipes.

13 (a) A form one student rubbed a matchstick head with soap in their laboratory. He then placed it on the surface of water in a tray as shown in the diagram below. He noticed that the matchstick moved in the direction shown by the arrow.

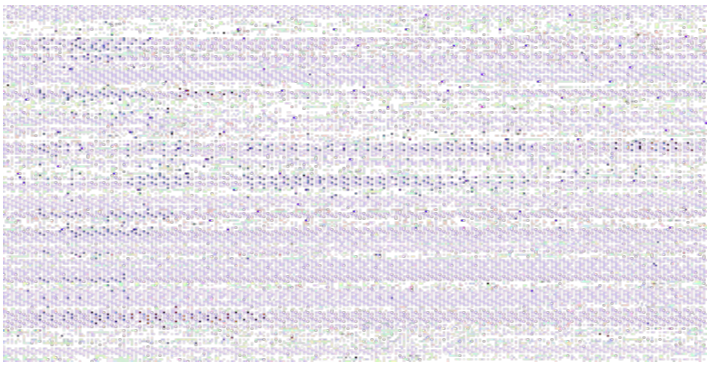


(i) Explain why the matchstick moved in the direction shown.

(ii) What happens to the matchstick after sometime?

Explain your answer.

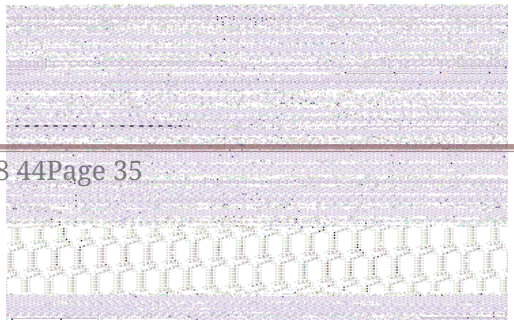
b) The figure below shows a rubber sucker. It is pulled by a spring balance. When the sucker is just about to be pulled off the surface, the spring reads 1000N.The area covered by the sucker is $2.5m^2$.



(i) Explain why the sucker sticks on a smooth flat space?

(ii) Determine the pressure of the air in Nm^{-2}.

(iii) State two applications of the rubber sucker?

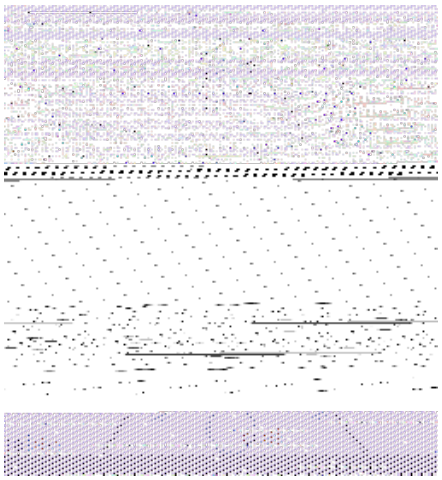


(c) A football is kicked away from the goal post and spins in the air as shown in the diagram below.

(i) Indicate on the diagram the direction of movement of the ball.

(ii) Explain why the ball moves in the direction you have in (i) above.

(d) A form two student covered a light tennis ball with a funnel. He blew air as shown in the diagram.



(i) State what is observed as the air is blown through the funnel.

(ii) Explain your observation made in (i) above.

(e) Differentiate between *streamline flow and turbulent flow.*

(f) Modern buses have their boots for keeping luggage under the seats. Explain briefly how the stability of the bus is improved by this method.

4. LINEAR AND CIRCULAR MOTION

1(a) Define the following as applied to motion:

(i) Linear motion

ii) Speed

iii) Displacement

iv) Velocity

v) Distance

b) State the units of each in (a) above and name whether it's a scalar or e vector quantity.

c) Calculate the average speed in meters per second of a marathon runner who takes 2 hours 15minutes to run 42.5km.

d) Sketch a displacement time graph for

i) Uniform velocity

ii) Stationary body

iii) Uniform acceleration

iv) Negative uniform acceleration

e) Sketch a velocity time graph for

i) Uniform acceleration

ii) Non uniform acceleration

iii) Stationary body

iv) Falling body

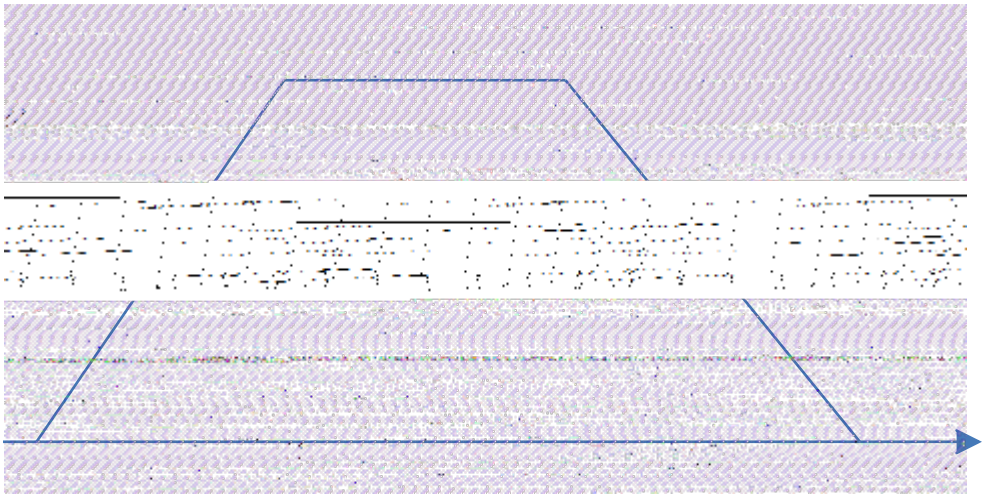
f) A car starts from rest and accelerates to $20ms^{-1}$ in 5s.

i) Find the acceleration of the car

ii) If the same car was then brought o rest in 10s. What is its retardation?

2(a) The graph below shows the distance covered by body with the time taken.

d(c



(a) Explain what happens between:

(i) The first 10 seconds

(ii) The 10s and 20s

(iii) And, after 20s.

(b) (i) the total distance covered by the body during the period of 30s.

(ii) Calculate the average speed of the body

(iii) The acceleration and retardation of the body

c) i) State the newton's equations of uniformly accelerated motion

ii) A body undergoing uniform acceleration had its velocity increased from $20cms^{-1}$ to $50cms^{-1}$ while it travels 500cm. What is its acceleration and how long does it take to travel the 500cm?

d) Explain the differences between speed and velocity; uniform acceleration and constant acceleration.

e) Describe an experiment to determine the acceleration due to gravity using a single pendulum bob.

3(a)i) Define the terms "**velocity**" and "**acceleration**"

(ii) Choose of these terms and explain, what is meant when the quantities above in (i) are said to be "**Uniform"**

b) An object was thrown vertically upward and its height above the ground was recorded at various times.

The results obtained are shown in the table below.

Times(s)	1	2	3	5	6	7	8
Height (m)	0	35	60	75	60	35	0

Plot a graph of height against time

From your graph, find:

(i) the maximum height reached

ii) time taken to reach this height

Using either or both of the answers from parts (a), Calculate the initial velocity with which the object was thrown.

c) Describe an experiment to determine the velocity and acceleration for a body in linear motion.

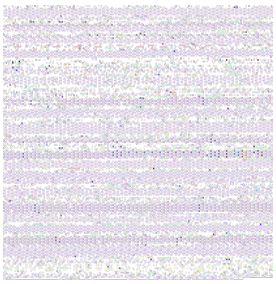
d) What is meant by *acceleration due to gravity?*

4(a)(i) What is circular motion?

ii) Distinguish between centripetal force and centrifugal force.

b) Explain why an object dropped from a tower dose not d fall perpendicularly but takes a curved path.

c) State the two types of velocities with which the body in (b) above will have. Which of these velocities will remain constant?



d) A body attached to a string is swung in a vertical circular path in air as shown.

Copy the diagram and on it indicate and name all the forces acting on the body if the body is moving in an anti-clockwise direction.

e) Explain how circular motion is applied in the separation of particles with different densities.

f) Explain why a body moving in circular path with constant speed is said to be accelerating.

5(a) Define

(i*) The scalar quantity*

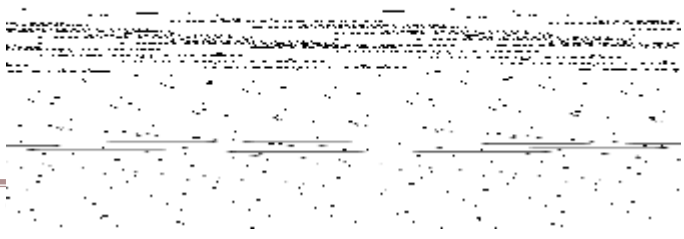
ii) The vector quantity

b) Differentiate between scalar quantity and vector quantity.

Give at least three examples of each

c) What is meant by *the resultant force?*

d) A 30ms^{-1} wind is blowing due north. What is the magnitude and direction of the velocity of an air plane travelling at an air speed of 70ms^{-1} when it is heading



(i) North (ii) South (iii) East?

e) The diagram below represents three forces 12N, 45N, and 10N acting on a body of mass 5kg.

(i) Calculate their resultant force

(ii) Find the acceleration of the body.

f) A boat whose speed with respect to the water is $3ms^{-1}$is sailing downstream at 90^0 angle with the current whose speed is $1.2ms^{-1}$.What is the resultant speed and direction of the boat.

6)(a) Define *linear momentum* and state its S.I units

b) State the *law of conservation of linear momentum*.

c) Distinguish between elastic and inelastic collision.

d) i) Explain with the aid of a labeled diagram, the principle of operation of a rocket engine.

ii) What bare the differences between a rocket engine and a jet engine?

e) A trolley of mass 2kg moving at $8ms^{-1}$ collides with another trolley of mass 3kg moving at $5ms^{-1}$. If the two trolleys move together after collision, calculate their common velocity, V_c

f) State any three applications in which the law of linear momentum is applied. .

g) Describe the structure and mode of operation of a jet engine.

h) A bullet of mass 100g is fired from a gun of mass kg. The gun recoils with a speed of $16ms^{-1}$. Calculate the velocity with which the

bullet is fired.

7(a) State *Newton's* laws of motion

b)(i) Explain why newton's first law is also called the law of inertia.

ii) Define *inertia and a newton.*

c) Explain each of the following:

i) a passenger standing in a train is thrown backwards when the train suddenly stops.

ii) a man standing in a lorry jerks backwards when the lorry suddenly starts moving forwards.

d) A man of mass 80kg stands in a stationary lift on earth.

Calculate his apparent weight when the lift:

i) Accelerates upwards at a rate of $2ms^{-2}$

ii) Falls freely under gravity.

(e) i) Describe a simple experiment to demonstrate Newton's first law of motion.

ii) Show that F=ma.

f) Explain why:

i) a gun recoils when a bullet is fired from it.

ii) a bullet fired from a gun eventually comes to rest instead.

g) A bullet of mass 0.006kg travelling at $120ms^{-1}$ penetrates deeply into a fixed target and is brought to rest in 0.01s. Calculate.

(i) the distance of penetration of the bullet in a target

(ii) the average retarding force exerted on the bullet.

8(a) Define the terms *friction and coefficient of friction*

(b) Distinguish between *static friction and dynamic friction.*

(c) How can friction between moving parts of an engine be reduced.

d) A locomotive of mass 1000kg is being pulled by a force of 5000N.If the frictional force acting on it is 50N.Find

(i) the effective force pulling the locomotive

(ii) the acceleration caused by the force.

(e) Discuss the frictional forces between the tyres of a motorcar and the ground when the car:

(i) Starts from rest

(ii) Skids in the forward direction

f) A water jet directed to a spot on the ground digs a hole in the ground. Explain.

9(a) Define *an impulse* and derive its relation to linear momentum of the body on which it acts.

b) two bodies of masses 200kg and 100kg travel towards each other

with velocities of $20ms^{-1}$ and $25ms^{-1}$ respectively, and join to form one body on collision.

(i) Calculate the common velocity V.

(ii) In what direction do they move after collision?

c) A small metallic ball is allowed to fall through glycerin.

(i) State the three forces acting on the ball as its falls through glycerin

(ii) Explain the term *terminal velocity*

(iii) Sketch a graph showing the variation of velocity of a ball with time.

(iv) Draw a second graph on the same axes, showing this relationship if water replaced glycerin.

(v) State two factors which affect terminal velocity.

d) An object of mass m has a weight W_1 in air and W_2 in water. Explain why W_1 is greater than W_2.

e) Describe an experiment to measure acceleration of a body using a ticker timer of frequency 50Hz.

5. WAVES THEORY AND ITS PROPERTIES

1(a)i) What is meant by the terms *wavelength, Frequency, Amplitude* as applied to waves?

ii) Differentiate between *music and noise*

iii) Explain the factors which determine the pitch and quality of a note produced by the tuning fork

(b) i) Describe an experiment to determine the speed of sound in air.

ii) Explain why reverberation in a concert hall is both desirable and undesirable

(c) i) Why is the moon often referred to as *a silent satellite*?

ii) The human ear can distinguish between two sounds as separate only if they reach it at least 0.1s apart. How far from a wall must an observer be in order to hear an echo when he shouts? (Speed of sound in air is $330ms^{-1}$)

(d) Distinguish between:

i) *Reverberation and an echo.*

ii) Transverse and longitudinal waves.

Give an example of each.

(e) Describe an experiment to show interference of waves in a ripple tank.

(f) A radio station broadcasts on a frequency of 200,000Hz and the wavelength of its signal is 1500m,

Calculate:

(i) The speed of the radio wave.

(ii) The wavelength of the signal of another station that broadcasts on a frequency of 1,250 kHz.

2(a) (i) What is *sound*?

(ii) Describe an experiment of determine the velocity of sound in air using a resonance tube

(b) A girl standing 300m away from a high vertical wall makes a loud sound of frequency 60Hz. If she takes 1.8 seconds to hear her echo, calculate the

(i) Speed of wound in air

(ii) Wavelength of the sound waves

(c) Distinguish between **transverse** and **longitudinal waves**, giving one example of each

(d) With aid of a diagram show how plane weaves are diffracted after passing through a

(i) Narrow opening

(ii) Wider opening

(b)(i) Distinguish between a *node* and *an antinode.*

(ii) Sketch a diagram of stationary waves corresponding to fundamental note and first overtone in closed pipe.

(iii) What is *an open pipe?*

(c) A progressive wave travels a distance of 31.5m in 20 seconds. If the distance travelled is equivalent to the distance between 10 consecutive crests. Calculate;

(i) the wave length of the wave.

(ii) the period of the wave.

(d)i) What are *ultrasonic waves?*

ii) A radio station transmits signals at a frequency of 103.7MHz. Find the wavelength of the signals and state any assumption made.

(e)i) Draw a diagram to show the pattern for a straight water wave passing through a narrow slit.
(ii) Describe an experiment to demonstrate that sound waves require a material medium for their propagation.

(iii) Explain how sound waves travel through air
(iv) Name four **(4)** differences between Mechanical waves and Electromagnetic waves.

3(a)(i) Distinguish between *refraction and diffraction of waves*.
(ii) Straight wave fronts are directed towards a barrier with a wide opening.
Draw a diagram to show the behavior of the waves after reaching the barrier.
(b) A man standing in a valley between two cliffs strikes a gong. He hears an echo from one cliff 0.7 s later and from the other 0.2 s after the first. Determine the width of the valley if the speed of sound is 340 ms^{-1}
(c)(i) What is *an echo?*
(ii) Explain why echoes are not heard in small classrooms.
(iii) Describe how unwanted echoes are eliminated from concert halls.
(d) Give **the** differences between:
(i) Light waves and sound waves.
(ii) Mechanical waves and electromagnetic waves
e)State and explain the differences between progressive waves and stationary waves.

4) (a)(i) Describe the *nature of sound wave.*

(ii) Explain the main factors that determine the velocity of sound in air.

iii) Describe an experiment to show that sound needs a material medium for its propagation.

iv) Describe how ultrasonic waves are used to determine the depth of a sea.

b)i) What are *beats?* Explain how beats are formed, and state two applications of beats

ii) What is meant by r*esonance*?

iii) Describe an experiment to demonstrate resonance in a tube using a resonance tube and water.

c) Explain the meaning of the following terms:

i) *Forced vibration and forced frequency*

ii) Forcing frequency and natural frequency

d) i) State the three factors affecting the frequency of a vibrating string.

ii) Explain why there are four strings of different thickness in a guitar.

iii) What does a guitarist do:

1) to tune his /her instrument?
2) to change the note emitted by a particular string?

e) A person with his or her ear to the rail can hear the sound of s train coming although the sound is in an audible when he or she stands up. Explain.

5(a)i) Explain why sound does not travel through a vacuum.

ii) State and explain the factors that affect the speed of sound in

different states of matter.

iv) What are the factors that affect the speed of velocity of sound in air? Explain the briefly.

b) Describe briefly an experiment to show that light travel faster than sound.

c) With the aid of a labelled diagram, describe an experiment that demonstrates sound travels through a medium not a vacuum.

d) Explain with aid of a diagram, what happens to a speed of sound when it travels from shallow water to deep water.

e) Explain why a vibrating tuning fork sound louder when the stem is touching a bench than when its suspended in air.

6(a) Define the following terms as applied to sound waves.

i) reflection

ii) diffraction

iii) echelon echo

iv) echo

b) i) Describe an experiment to demonstrate reflection of sound waves.

ii) State four applications of reflected sound waves (reflection).

c) i) Describe the echo method of measuring the velocity of sound in air.

ii) A man fires a shot and hears the echo return from a cliff after 1.6s. He walks 70m nearer the cliff and the echo of a second shot is heard after 1.2s. How far was the man from the cliff when he fired the first shot?

d) A girl at a distance of 165m from a high wall clamped her hands once but heard two claps.

i) Find how long it took her to hear the second clap.

ii) Give one practical application in which the principle in (d) is used.

iii) Explain why the girl heard two claps.
(Speed of sound in air is $330ms^{-1}$)

e) i) What is meant by *sound echo,* and what are the conditions necessary for its production?

ii) Briefly describe a practical use of echo production.

iii) Why are echoes not formed in classrooms?

7(a) Define the following terms:

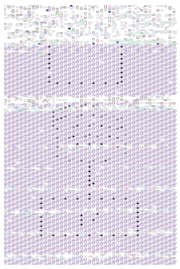
i) *Fundamental frequency*

ii) Overtones

iii) Harmonics

b) A tuning fork produces a musical note at a frequency of 320hz. Calculate the wavelength of the sound produced in air if the speed of sound in air is $340ms^{-1}$.

c) A mass m is attached below a spring balance as shown in the diagram below. It is slightly pulled downwards and released, describe the type of motion displayed.



d) State two conditions that must be satisfied for constructive interference to occur.

e) How are unwanted echoes e.g. in concert halls eliminated?

8)a) Explain the following terms:

i) a ray

ii) Wave front

b) With the aid of a diagram, distinguish between circular and plane

wave fronts.

c) Draw the following reflection patterns for:

i) straight waves hitting straight barriers normally and obliquely

ii) straight waves hitting both concave and convex barriers

iii) circular waves hitting a straight barrier ,concave barrier and convex barrier

d)i) Explain the term *diffraction.*

ii) With the aid of a diagram, describe what happens when plane waves are incident on the gap between two obstacles in a ripple tank when the gap is very wide; and when the gap is very narrow

e) Explain how diffraction is affected by

i) Width of the aperture

ii) Wavelength of the incident waves.

f) State the applications of diffraction and interference of waves in daily life.

9) a)i) What is *refraction* as applied to wave motion?

ii) State the other changes that occur to a wave when it undergoes refraction other than change in speed of the wave.

iii) Explain how the frequency, wavelength and velocity of a wave are affected when it moves from shallow water to deep water.

b) State any changes that occur in a wave when it is travelling from deep water to shallow water and is perpendicular to the boundary

between shallow and deep water.

c) State the conditions which must be fulfilled in order that two waves continuously interfere and produce no effect at a point in the medium.

d) With the help of a diagram, explain the differences between constructive and destructive interference.

e) Explain the nature of sound heard when two sound waves meet to produce:

i) Constructive interference

ii) Destructive interference.

10)a) Explain each of the following observations:

i) Sound from a distant source is louder at night than during the day

ii) An observer can hear sound from a source which is behind a building.

b) Describe an experiment to show interference of sound waves.

c) i) What are the differences between *stationary waves and progressive waves?*

ii) Explain how stationary waves are formed.

iii) State the properties of stationary and progressive waves

d) i) What is meant by *nodes and anti-nodes?*

ii) Water waves are observed as they pass a fixed point at a rate of 30crests per minute. A particular wave crest takes 2seconds to travel

between two fixed points 6m apart.

Determine for the wave:

1. The frequency,
2. and wavelength.

e) i) State the factors that affect the fundamental frequency of vibrations in a stretched string

ii) Explain how sound waves travel in air.

11)a) What is: i) *A wave*? Explain how a wave is produced.

ii) *A pulse*?

b) Distinguish between:

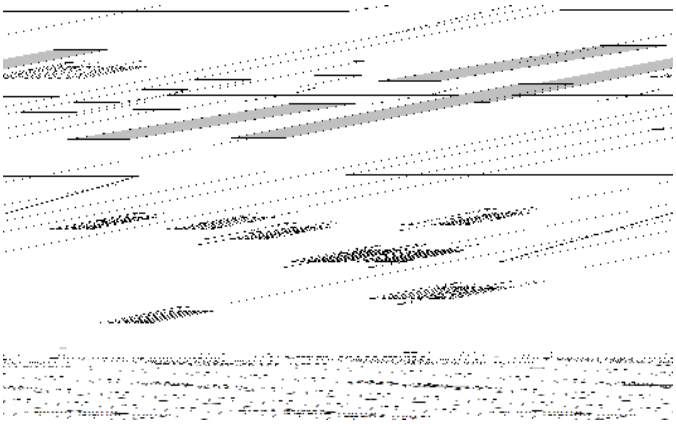
i) Progressive and stationary waves

ii) Mechanical and electromagnetic waves

iii) Longitudinal and transverse waves

Name two examples of each of the above.

c) The figure below represents an oscillation taking place at a particular point while a sound wave in a gas passes the point. The vertical axis is labelled displacement (mm)



i) Explain what is meant by *displacement* in this context.

ii) Using the information in the figure above:

Define and **determine;** ***the period, the frequency, and the amplitude.***

iii) Calculate the wavelength of the sound in the outline. (take the velocity of sound to be $340ms^{-1}$)

iv) On the same axis sketch another graph which has the same frequency as the one already drawn but slightly lower loudness.

v) state two factors that can increase the speed of sound in solids

d)i) Derive the relationship between T and f, and the one relating v, f and λ for a wave travelling from one point to another.

ii) At 25^0C, the speed of sound in air is $346ms^{-1}$, while at 0^0C, the speed of sound in air is $331ms^{-1}$. Explain why the speed decreases as the temperature decreases.

iii) If a set of waves travels with a velocity of $1400ms^{-1}$ and has a wavelength of 35cm, what is the wave frequency?

e)i) Define the term *reflection* as used in waves.

ii) State the laws of reflection of waves.

12) a) Define the following terms as applied to sound:

i) Intensity

ii) Pitch

iii) Loudness

iv) Frequency

b)i) Distinguish between *music and noise*.

ii) State the factors that affect the frequency of a vibrating string.

iii) Describe an experiment to investigate the relationship between tension of a string (wire) and its frequency of vibration.

c) A sonometer wire 200cn long vibrates with a fundamental frequency of 320 Hz when its tension is 50N. Calculate in two ways, how this frequency should be adjusted to 520 Hz.

d) A resonance tube is filled with water. A Vibrating tuning fork of unknown frequency is held above the mouth of the tube as water is emptied. If a loud note is first heard when the length is 30.0cm.

(i) Calculate the frequency of vibration of the fork if the velocity of sound is $340ms^{-1}$

(ii) Find the length of the air column when a loud sound is next heard.

(iii) Explain why these results are only approximated. How can better results be obtained?

6. OPTICS AND ITS PROPERTIES

1(a) Explain the term *refraction of light*.

(b) Describe an experiment you would use to measure the index of glass using a glass block.

(c)(i) State the conditions for total internal reflection to occur.

(ii) State two applications of total internal reflection.

(iii) Calculate the critical angle of an air glass interface if refractive index of glass 1.5.

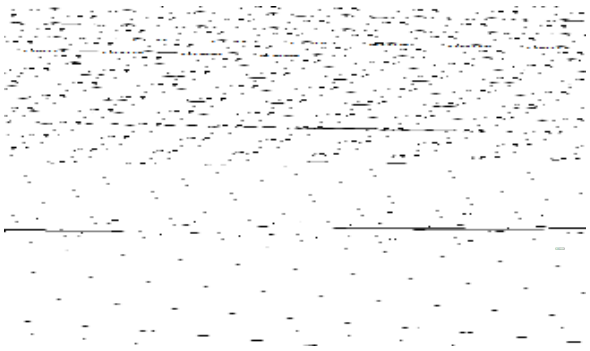
(d) What is meant by the following terms?

(i) Critical angle

(ii) Total internal reflection.

(iii) Mirage formation

(e) Explain briefly how sky radio waves travel from a transmitting station to a receiver.



2(a) The diagram in the figure below shows a ray of yellow light incident at an angle of 50^{o} on one side of an equilateral triangular glass prism of refractive index 1.52.

(i) Calculate the angles marked r and e.

(ii) State and explain what would be observed if the ray above were of white light.

(b) Explain with the aid of the diagram, why the writing on a piece of paper placed under a glass block appears raised when observed from above.

(c) State;

(i) the conditions necessary for total internal reflection.

(ii) one application of total internal reflection.

(d) State the *laws of refraction.*

(e) What do you understand by the *principle of reversibility of light*?

(f)(i) Describe an experiment to determine the refractive index of glass by the real and apparent depth method.

(ii) State the causes of refraction of light.

(iii) Name three effects of refraction of light rays.

(g) Why does a stick appear bent when partially immersed in a liquid? Show this effect on a suitable diagram.

3(a) State the principle of *reversibility of light*.

(b) A ray of light of incident at an angle of 30 on a water –air surface Find the angle of refraction in the air ($n_{w=1.33}$)

(c)(i) State *Snell's law.*

(ii) Describe an experiment to verify Snell's law.

(d) The real depth of a pond is 6m.An object at its bottom appears to be 5m below the surface of a pond. Find the refractive index of water in the pond.

(e)(i) Draw diagrams to show how critical angle and total reflection occurs.

(ii) Find critical angle for water whose refractive index is 1.33.

(f) Define the *real and apparent depth*.

(g) (i) Explain the advantages of using prisms over plane mirrors

when used in optical instruments.

(ii) With the aid of a diagram, explain the principle of operation of a prism periscope.

4(a) Define the terms:

(i) *Dispersion* of white light

(ii) Pure spectrum

(iii) Colour filter.

b) Describe the effect of light filters on colour of a spectrum

c) Define the following terms:

i) Primary colour

ii) Secondary colour

iii) Complimentary colour

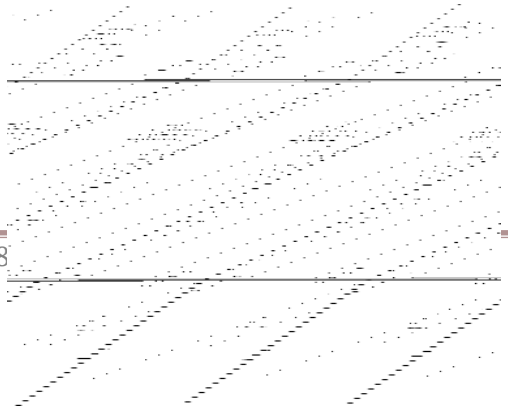
Give examples of each of the above defined terms.

d)i) Draw the complete electromagnetic spectrum in order of increasing wavelength.

ii) State the general properties of the above electromagnetic spectrum

iii) State the uses of each of the components of the electromagnetic spectrum.

e) With the aid of a labelled diagram, describe briefly how a pure spectrum is produced.



f) i) Distinguish between *a primary* and *secondary colour.*

ii) The figure shows colours mixed by addition. Name the colours represented by the parts labelled A, B, C, and D .

g) State why most car registration number plates are printed black on a yellow background.

h) Explain why the sun appears red at sunset and sunrise.

5(a) Explain the phenomena of *dispersion* as applied to white light.

(b) Draw a rays diagram to shown the dispersion of white light by a glass prism.

c) Name the colour that would be obtained when the following coloured lights were mixed:

(i) green and red

(ii) cyan and red

d) Explain why an object illuminated by white light appears:

(i) Coloured

(ii) Black

e) Explain the following:

(i) The colour of a cyan filter when red light is passed though it

(ii) The colour of a magenta surface under yellow light.

6(a)(i) Explain the statement *"the refractive index of glass is 1.5"*

(ii) Distinguish between refractive index and absolute refractive index of a material.

(iii) Describe an experiment to measure the refractive index of glass in form of a rectangular prism.

b) (i) What is meant by *total internal reflection of light?*

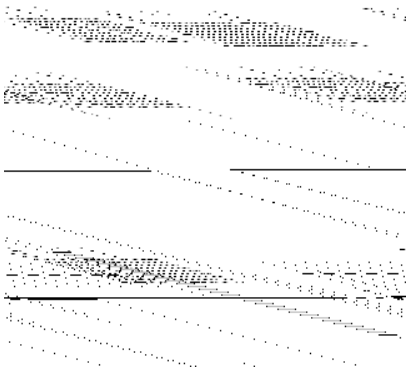
(ii) State the conditions under which total internal reflection occurs

(iii) Define critical angle and explain how the critical angle for a material in air depends on its refractive index.

(iv) Name two practical applications of total internal reflection

(c) Find the angle of incidence for a ray of light on one face of a 60^{o} prism if the ray is just totally internally reflected on meeting the next face.

d) The figure shows the path of light through one corner of a cube of ice. Find :



(i) the angle of incidence on the face AB

(ii) the angle of refraction at this face.

Mark, on the diagram, the critical angle or ice, and mark also the direction of any one additional ray which can occur owing to partial reflection.

7(a) Define the *lens.*

(ii) Write brief notes on each of the following as applied to lenses:

Centre of curvature, Optical centre, Principal axis, Principal focus, Focal length.

(iii) Distinguish between *a real image and a virtual image*.

b) An object 8cm high is placed perpendicularly on the principal axis 12cm away from a diverging lens. By graphical construction, find the focal length of the lens, if the height of the image formed is 2cm.

c)i) What is the *power of a lens.*

(ii) A concave lens has focal length of 3cm. Calculate its power.

d)i) Define *linear magnification* as applied to lenses.

ii) An object of height 4cm is placed perpendicularly on the principal axis at a distance of 45cm from a converging lens of focal length 15cm. By graphical construction, determine: the position and magnification of the image

e) Describe an experiment for determination of focal length of a convex lens using:

(i) a distant object

(ii) an illuminated object and a plane mirror

(iii) a wire gauze, meter rule, source of light and a white screen.

f) Explain how a projection lantern works.

8(a)(i) Explain how a lens camera works.

(ii) State the uses of the main parts of a lens camera.

(b) State the differences between a lens camera and the eye.

(c) Draw a diagram to show how a converging lens can be used as a magnifying lens.

d) State two differences between a pinhole camera and a lens camera.

e) With the aid of a diagram, explain why a pond appears shallower than it actually is.

f) With the aid of a labelled diagram, describe a simple experiment to determine the focal length of a converging.

g) An object of height 4cm is placed normally on the principal axis at a distance of 45cm from a converging lens of focal length 15cm. By graphical construction determine:

(i) the position of the image

(ii) the magnification.

h) Give two uses of converging lenses.

9(a) Explain the following terms as applied to a thin converging lens.

(i) *Principal focus*

(ii) Focal length

(iii) Power.

(b) An object is placed at right angles to the principal axis of a thin converging lens of focal length 10cm.A real image of height 5cm is formed at 30cm from the lens.

Find, by construction the position and height of the object.

(c) With the help of a ray diagram show how a converging lens can be used as a magnifying glass.

(d) State any two advantages/ applications of converging lens.

(e) Draw a ray diagram to show

(i) how a real diminished image, and

(ii) a virtual magnified image, can be formed by a converging lens.

f) i) What is a *real image?*

ii) Explain, with the help of a ray diagram, how a convex lens forms a real image of a small object close to its axis.

g) i) What is meant by the term *parallax*?

ii) Describe an accurate method of determining the focal length of a convex lens.

h) Draw a diagram of a slide projector and use it to explain the function of the condenser lens and of the concave mirror placed behind the light source.

i) Mention *two* ways in which a photographic camera is similar to human eye and *one* way in which it is different.

10(a) What is *a pure spectrum*?

(b) In the formation of the spectrum of white light by a prism:

(i) which ray is deviated least?

(ii) which ray is deviated most?

(c) Explain with the aid of a clear diagram, how a pure spectrum is produced.

(d) Explain, with ray diagrams, how a glass prism:

(i) Deviates, and

(ii) Disperses a ray of white light incident upon it.

(e)i) Draw a labelled ray diagram to show how a pure spectrum of white light may be produced.

(ii) Describe and explain the appearance of the spectrum if:

-a sheet of blue glass is inserted in the path of light:

-sheets of red and yellow glass are inserted together in the path of the light, the blue having been removed.

(iii) What is seen when a pure spectrum of white light is formed on a red screen in a dark room?

f) A plant with green leaves and red flowers is placed in:

(i) green;

(ii) red;3

(iii) blue light.

What colour will the leaves and flowers appear in each case?

Assume that all the colours are pure.

g) Describe the appearance of a red tie with blue spots when observed in: (i) red light (ii) green light.

h) State four ways in which visible light and radio waves are similar and two ways in which they are different.

11(a)(i) What is meant by *reflection of light*?

(ii) State the laws of reflection of light.

(iii) Describe an experiment to verify the laws of reflection of light.

b)i) What is meant by *reversibility of light*?

(ii) Explain the principle of operation of a pinhole camera.

iii) Explain what happen to the nature, type, size and magnification of the image formed by pinhole camera when:

1- the size of the pinhole is enlarged

2- the distance between the pinhole and the screen either increased or decreased

3- the nature of the final image.

12(a) Define *a real image* and state its characteristics.

b) State and explain the characteristics of image formed by plane mirrors

c) Describe a simple experiment to show that light travels in straight lines.

d) Explain a simple experiment to locate the image of an object as seen in a plane mirror. State the result expected.

e) Illustrate with diagrams, all the characteristics of images formed by plane mirrors.

f) Describe a simple experiment to the use of plane mirrors in making simple periscope.

g) i) Distinguish between shadows and eclipses. Where necessary draw all the possible diagrams.

(ii) Explain how both partial and total ellipses of the moon are formed.

h)i) What is meant *light?*

(ii) Describe an experiment to verify the laws of reflection of light.

13(a)i) Distinguish between *a real image and a virtual image*

(ii) Explain how a concave mirror can give either kind of image in (i) above.

(iii) Illustrate each case in (ii) above by a ray diagram.

b) Show on a ray diagram the *centre of curvature, axis, pole, focal length, and principal focus* for a concave spherical mirror.

c) Describe and explain how to measure and find by:

(i) Optical method,

(ii) Experiment, the radius of curvature of a concave mirror.

d) Show on a ray diagram the *centre of curvature, axis, pole, focal length, and principal focus* for a convex spherical mirror

e) Explain what is meant by the terms *centre of curvature,*

principal axis, pole, focal length, and principal focus of a spherical mirror.

Illustrate your answers with labelled diagrams of :a concave mirror and a convex mirror.

g) An object 2cm long is placed 40cm in front of a concave mirror of focal length 15cm so that it is perpendicular to, and has one end resting on, the axis of the mirror. Find by means of a ray diagram, drawn to suitable scales, the size and position of the image.

14(a) Give two reasons why convex mirrors are frequently used as driving mirrors.

b) A concave mirror is used to form an image of an object pin. Where must the object be placed to obtain:

(i) an upright, enlarged image

(ii) An image the same size as the object.

(iii) A virtual, enlarged image

c) Describe an experiment to determine the focal length of

(i) a concave mirror

(ii) a convex mirror

d) A concave mirror of radius of curvature 20cm forms an erect image 30cm from the mirror and 5cm high. Find the position, and size of the object and show with a scale diagram how the image is formed.

15(a) Explain *an annular eclipse* as a special form of solar eclipse.

(b) State three modifications that can be done on a pinhole camera so that it can be used to take still photographs.

(a) Explain the differences between regular and irregular reflection.

(b) State the *laws of reflection*.

(c) If the angle between the incident ray and the reflected ray in a plane mirror is 70, calculate the angle of reflection.

(d) Explain the meaning of the following terms as applied in light.

(i) *Lateral inversion*

(ii) a ray

(iii) a beam

(e)i) State two advantages of using a pinhole camera in taking photographs compared to the modern lens camera

(ii) What is the effect of moving the pinhole away from the object?

(f)i) A pinhole camera forms an image of size 5cm tall for an object placed 25cm away from pinhole. If the height of the object is 5cm, find the length of the pinhole camera.

(ii) State two characteristics of an image formed by a pinhole camera

g) Two plane mirrors M_1 and M_2 are inclined at an angle of 45^0 to each other as shown below. A Candle is placed between them. Determine the number of images.

h) A boy stands 4m in front of a big plane vertical mirror .A girl stands 3m behind the boy.

(i) Find the distance of the image of the boy from the girl

(ii) If the boy moves 1m towards the mirror, find the distance of the image of the girl from the boy.

(I) State three effects demonstrate that light travels in a straight line.

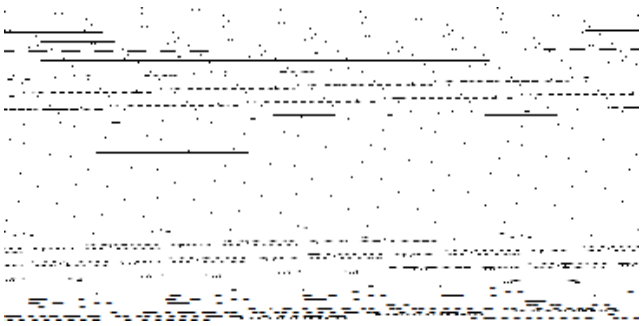
(j) Illustrate using a ray diagram how:

(i) a small light source produces a shadow.

(ii) an extended light source produces a shadow.

(k) Describe the nature of the image formed by a pinhole camera.

16(a) The figure below shows a layer of liquid confined between two transparent plates X and Y of refractive indices 1.54 and 1.44 respectively. A ray of light making an angle of 40^0 with the normal to the interface between medium x and the liquid is refracted through an angle of 50^0 by the liquid. Find the



(i) Refractive index of the liquid

(ii) Angle of refraction, r in the medium Y

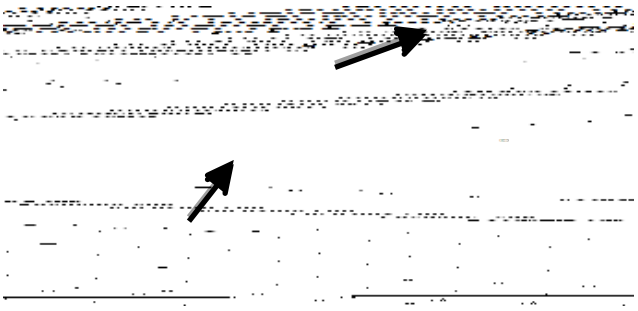
(b) State the conditions for total internal reflection to occur.

(c) State one special case when a ray of light passes from one

medium into another.

(d) Explain the observation that would be made for a ray of light passing from paraffin to water, given that paraffin is optically denser than water.

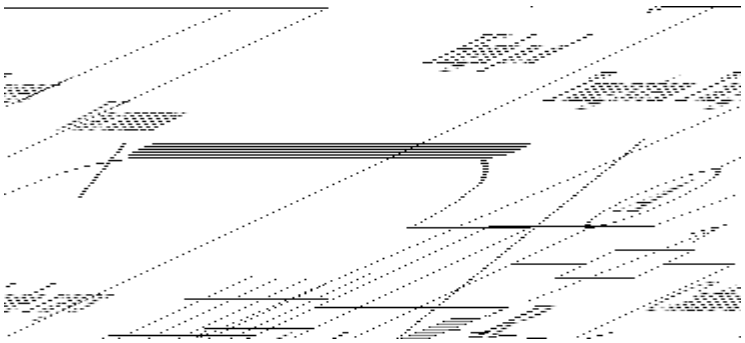
(e) The figure below shows a ray of light incident on a semi-circular glass block of centre O.



(i) Why is the ray not deviated entering the block at A?

(ii) Calculate the value of angle (⁰ if the refractive index of glass is 1.52.

(f) The figure below shows a ray of light incident on one face off a block of ice of refractive index 1.31 and totally internally reflected at the adjacent face.



Determine

(i) Angle (°

(ii) Angle x

(iii) Angle (°, the greatest angle for which the total internal reflection is possible.

17(a) What do you understand by the following terms in refraction of light?

(i) *transmission density'*

(ii) Reversibility of light

(iii) Critical angle

(iv) Refractive index

(v) Total internal reflection

(b)(i) Express refractive index in terms of real depth and apparent depth

(ii) Describe an experiment to determine the refractive index of a transparent liquid using real and apparent depth method

c) Explain the following terms:

(i) *Dispersion of light*

(ii) Pure spectrum

d) Explain why violet light is deviated most by glass prism.

e) Draw ray diagram demonstrating how pure spectrum of whiter light may be produced.

f) Explain the terms spherical and chromatic aberration, and state how the defects can be corrected.

7. MODERN PHYSICS

1) i) What are *X-rays*?

ii) With the aid of a well labelled diagram, describe how are x-rays produced?

iii) Explain why the x-ray tube must be evacuated.

b)i) Why are cooling fins necessary in an x-ray tube?

ii) What is the speed of X-rays, and explain why the target in the x-ray tube is made of molybdenum?

iii) Distinguish between *soft and Hard X-rays?*

c) i) Briefly describe the energy changes which occur in an x-ray tube when in operation.

ii) In which way do X-rays differ, and are similar from or to gamma rays?

iii) Explain why people are advised against exposing themselves to X-rays unless it is absolutely unavoidable.

iv) Explain how the intensity and penetrating power of x-rays can be improved

d)i) State the seven properties of x-rays

ii) State the biological and industrial uses of x-rays

(e)i) What is meant by the term *thermionic emission*?

ii) State two differences between cathode rays and x-rays

iii) In an x-ray machine, state the factor(s) considered when choosing a material for:

1. shielding

2. metal target

3. cooling system

2a)i) What are *Alpha, beta and gamma Particles*?

Explain their nature as seen in a diffusion cloud chamber.

i) State five differences between **alpha** and **beta** particles.

ii) With the aid of a labelled diagram ,describe an experiment to distinguish between beta and gamma radiations from the same source

bi) Define the terms ***radioactivity*** *and* ***Half-life*** of a substance.

ii) A radioactive substance $^{238}_{92}X$ decays by emitting 4 alpha particles and 5 beta particles. Find the mass number and atomic number of daughter nuclide.

c)i) Distinguish between ***nuclear fusion*** *and* ***nuclear fission***, give an example where each naturally occurs.

d) The half of a radioactive substance is 24 days calculate the mass of the substance which has decayed after 72 days if the original mass is $0.64\,g$.

e) Explain the nature of the atom.

f) State what happens to a beta, alpha and gamma particle as it passes in between:

i) two oppositely charged plates

ii) the magnetic field is perpendicular to and directed out of the paper

3 (a)(i) What is *a radioactive nuclide*?

(ii) When lithium is bombarded by neutrons, a nuclear reaction occurs which is represented by the following equation $^{6}_{3}Li + ^{1}_{o}n \rightarrow ^{3}_{1}H + P$ .complete the equation and name P.

(b) i) Give three differences between alpha and beta particles

ii) Draw a well labeled diagram of a Geiger Muller tube. Explain

how it detects radiations.

iii) Name any three precautions which must be undertaken by one working with ionizing radiation.

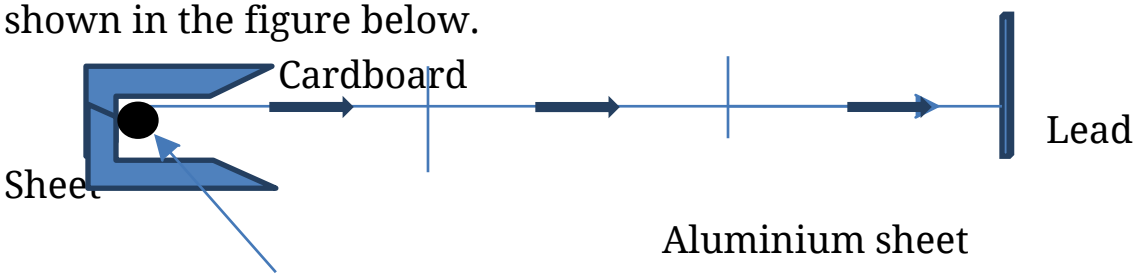
(c) i) Explain the meaning of *background radiation.*

ii)Give two possible sources of the background radiation

d) With the aid of a labelled diagram, describe an experiment to distinguish between beta and gamma radiations from the same source.

e) A radioactive element X decays by emitting an alpha particle and gamma rays. Write a balanced equation for the decay.

f) A radioactive source which emits all the three radiations is placed in front of a cardboard, aluminium and lead sheets as shown in the figure below.



Name the radiations likely to be between the

(i) cardboard and aluminium

(ii) aluminium and lead sheets

g) Give any five applications of radioactivity

4(a)i) What are *cathode rays?*

ii) State five properties of cathode rays; where possible also illustrate them with diagrams.

iii) State four uses of cathode rays.

b) In a cathode ray oscilloscope, explain the effect of the

following on the brightness of the electron spot on the screen.

(i) increasing the filament current

(ii) Decreasing the filament current

c)i) Explain with the aid of a well labelled diagram, how cathode rays are produced in a CRT.

ii) Explain why cathode ray tube (CRT) is made of vacuum

iv) Explain the functions of the main elements of a CRO

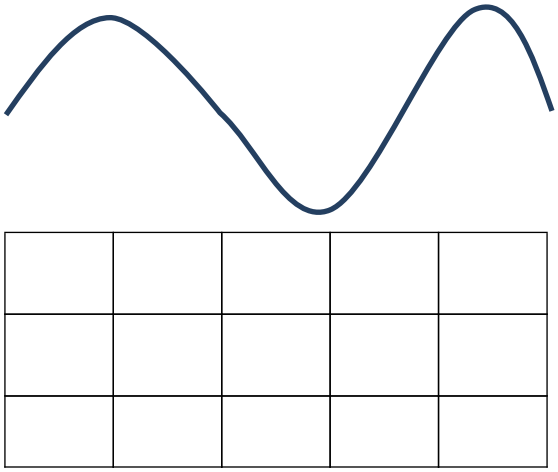
d)i) How does a common CRO differ from a TV tube?

ii) How is the production of as colored picture achieved in a color television?

iii) Describe an experiment to show that cathode rays travel in straight lines.

e) Distinguish between *thermionic emission and photoelectric emission*.

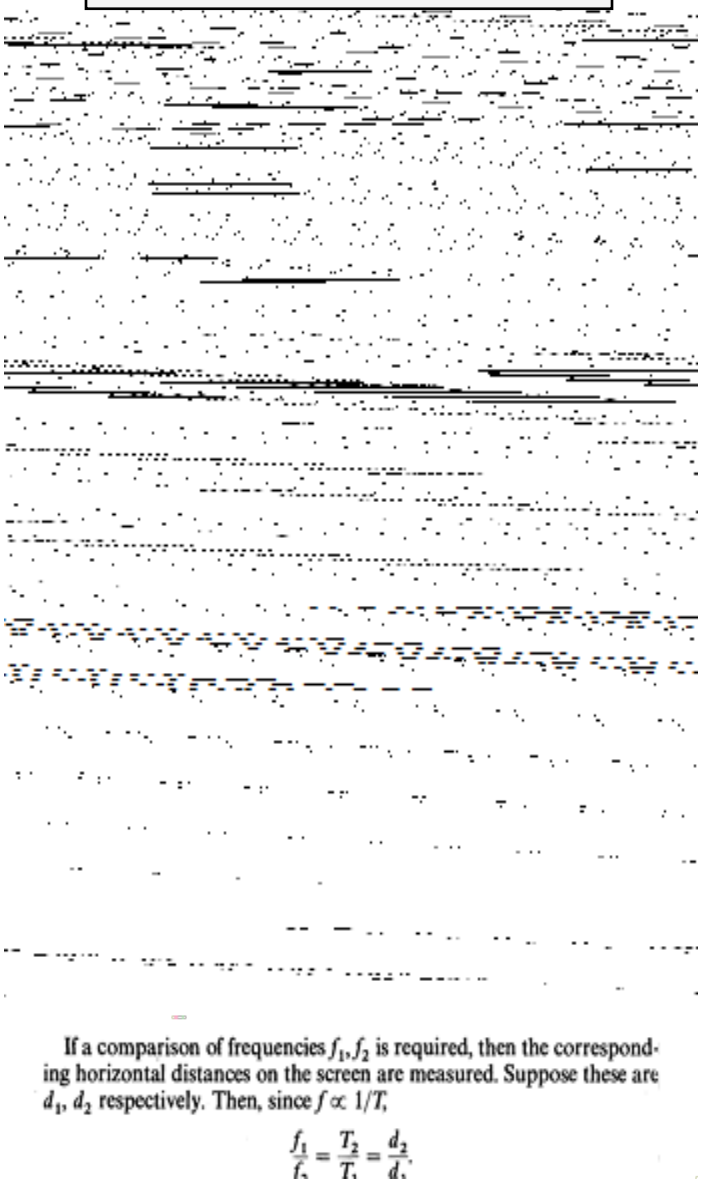
f) Explain how different traces of cathode ray beams on the screen of a cathode ray tube may be obtained. Illustrate them.



The time base in  the figure above is set at 1ms/div and the y-gain is set at 50V/div. Calculate :(i) the frequency of the a.c signal

ii) the peak voltage of the input signal.

Reference Example



If a comparison of frequencies f_1, f_2 is required, then the corresponding horizontal distances on the screen are measured. Suppose these are d_1, d_2 respectively. Then, since $f \propto 1/T$,

$$\frac{f_1}{f_2} = \frac{T_2}{T_1} = \frac{d_2}{d_1}.$$

4 (a) Define the following terms:

(i) *atomic number*

(ii) mass number

(iii) isotopes.

(b) A radioactive nucleus decays by emission of alpha particles:

(i) What *is an alpha particle?*

(ii) What changes occur in mass number and atomic number when the alpha particle is emitted?

(iii) State any three differences between alpha particles and beta particles.

(c) i)What is meant by the *half-life of a radioactive material*?

(ii) The activity of a radioactive source decreases from 4000counts per

minute to 250count per minute in 40minutes.What is the half-life

of the source?

(d) The table below shows the count rates of a certain radioactive material.

Count rate (S-1)	0.64	0.59	0.50	0.42	0.32	0.21
Time (min)	0	1	3	5	7	9

Plot a graph and use it to find the half-life of the material.

5a) Define (i) *radioactivity*

(ii) *Isotopes* of an element as applied to radioactive nuclide.

b) i) State two differences between *nuclear fission and nuclear fusion*.

State where each of the above occurs.

ii) A radioactive nuclide x of atomic number 88 and mass number 226 decays by emission of an alpha particle and turns another nuclide Y. write a balanced equation to represent this nuclear reaction.

iii) A radioactive material has a half-life of 10days. If after 30 years, 250kg of it is remaining, what amount was present at the beginning?

c)i) Define a ***chain reaction***.

ii) Outline the processes involved in the generation of electricity using uranium -235

iv) With the aid of a labeled diagram ,describe briefly the how electrical energy in generated in a nuclear reactor

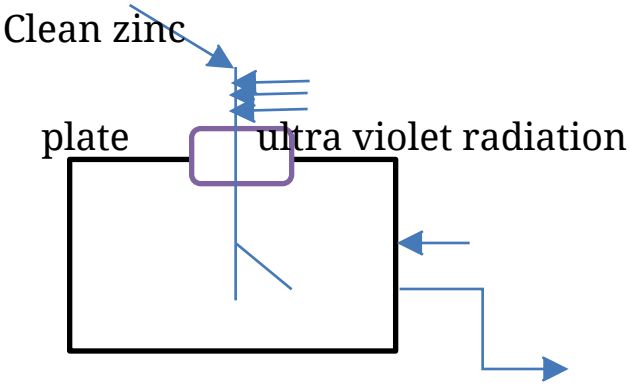
v) What are the main purposes of boron rods in a nuclear reactor?"

6(a)i) What is meant by the term ***photoelectric effect***?

ii) State the conditions under which photoelectric emission occurs.

iii) Describe a simple experiment to demonstrate photoelectric emission.

b) A freshly cleaned zinc plate placed on the cap of a gold leaf electroscope is irradiated with ultraviolet radiation.



Gold leaf electroscope

Earth

Explain what happens when the gold leaf electroscope is

(i) negatively charged

(ii) positively charged

(iii) Explain why the leaf of the electroscope does not fall when infra-red radiation is directed onto the zinc plate

c) State the effect on the electrons emitted by the photoelectric effect when:

(i) the intensity of incident radiation is increased

(ii) the frequency of the incident radiation is increased

d) State one reason for using a particular radiation such as ultra violet for a given photocell

e) Briefly explain any two applications of photoelectric effect

7(a) i) What is meant by the term *rectification*?

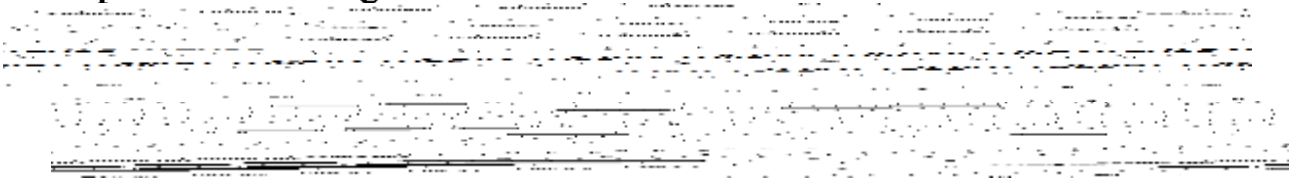
ii) Explain how half wave rectification is achieved

b) A junction diode is used as a rectifier. Draw a simple circuit diagram to show how two junction diodes and a centre tap transformer can be used to produce a full wave rectification.

c) Plot a graph of current I against p.d V.

1. $^{24}_{11}Na$ is a *radioactive isotope* of sodium which has a *half-life period* of 15 hours and disintegrates with the emission of *β-particles* and *γ-rays*. It emits *β*-particles that have energies of 4·2 *MeV*.)

Explain the meaning of the five terms that are italicized in the statement



Miscellaneous exercises.

8: ELECTRICITY AND ITS EFFECTS

1(a) Define the following terms:

(*i*) *Electric current*

(ii) A volt

(iii) Potential difference

(iv) Electromotive force

(b)(i) State *ohm's law*

(ii) Describe an experiment to verify ohm's laws

(iii) Draw the current voltage characteristics for non ohmic conductors

(c) State the factors that determine the resistance of a metallic conductor

(d) A cell of e.m.f E and internal resistance 1.0ohms is connected in series with a 2.0ohms resistor and a switch as shown in the figure. The voltmeter reads 1.5V when the switch is open.

(i) What is meant by ***e.m.f of a cell*** and ***internal resistance?***

(ii) Find the value of E

(iii) What will be the voltmeter reading when the switch is closed?

(e)i) Define electric power.

(ii) A 240V 600W water heater is used to boil water for 5minutes. Calculate

(i) The current that flow in the heater

(ii) The electrical energy converted into heat.

f) In a home there are four energy saving bulbs rated 11W and three 60W all arranged in parallel.

(i) What is the total energy used in 3hours.

(ii) If the cost of a unit of electricity is 570/=, what is the cost of running all appliances above.

(g)i) What is *a fuse?*

(ii) State two uses of a fuse in electrical wiring.

h) State two advantages of connecting appliances in parallel than in series in an electrical circuit.

I) A lamp is marked ***250W 230V.***What do you understand by this statement?

(i) Calculate the current it takes

(ii) The energy it supplies in 30 seconds.

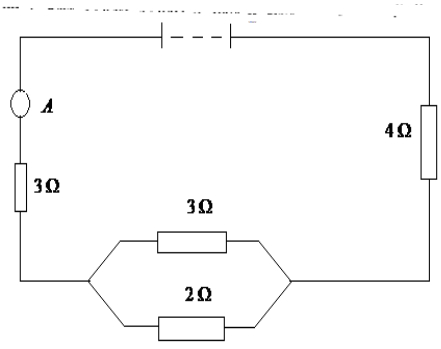
2a)i) Distinguish between *a primary cell* and *a secondary cell.*

ii) Identify two defects of a simple cell.

iii) How can these defects be minimized.

iv) Mention four ways of caring and maintaining a secondary cell.

b)i) Draw a well labeled diagram of a dry (Leclanch'e) cell.



ii) How is polarization overcome in a dry cell? c) Four resistors are connected across a 12 *V* battery, of negligible

internal resistance as shown in the figure.

i) Determine the reading of the ammeter A ii) the p.d across the parallel combination of resistors.

d) Name one instrument that turns chemical energy to electrical energy.

e) Derive an expression for the resistance of three conductors connected in

(i) in series

(ii) in parallel

3a) What are the advantages of alternating current over direct current?

b) Describe with the aid of a diagram, the construction and action of a transformer.

c) A transformer is designed to operate at $240\,V$ mains supply and deliver $9V$. The current drawn from the mains supply is $1.0\,A$. if the efficiency of the transformer is 90%, calculate:

i) the maximum out-put current.

ii) the power loss.

d) State 3 possible causes of the power loss in (c) ii) above and state how the power loss is minimized

e) A $240\,V$ mains transformer has 100 turns in primary and N turns in the secondary. It is used to supply energy to a $12\,V / 24\,W$ lamp.

i) How many turns are there in the secondary coil?

ii) What is the efficiency of the transformer if the current drawn

from the $240\ V$ supply is $125\ mA$?

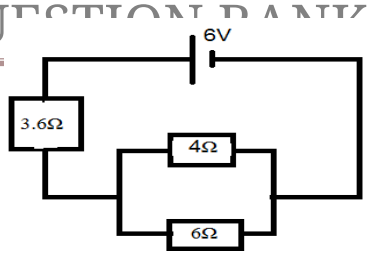
4. a) Define the following terms
   (i) *Electrical power*.
   (ii) the *kilowatt-hour*.
   b) Electrical power of 800 kW is transmitted through cables of total resistance 10 Ω at a p.d of 10kV to a factory which requires 420 V.
   (i) Determine the current in the transmission lines.
   (ii) Calculate the power loss in the transmission lines.
   (iii) What happens when the power is transmitted at 420V?
   c) Explain the functions of the following devices in a domestic house wiring or electrical installation:
   (i) the fuse.
   (ii) the earth wire.
   d) A 2 kW electric fire is used for 10 hours each week and a 100 W lamp is used for 10 hours each day. Calculate the cost of using these appliances for a week if 1 kWh costs sh. 500/=.
   e) State two advantages of having parallel circuits and connections of appliances over series connections.

4(a) Explain what happens when two insulators of different materials are rubbed together

(b) Describe how a lightening conductor safe guards a building from lightening.

(c) State ***Ohm's law***

(d) A battery of e.m.f 6Vand negligible interval resistance is connected to 3.6Ω, 4Ω and 6Ω resistors as a shown in figure.



Find the:

(i) Total current flowing through the circuit.

(ii) Power dissipated in the 3.6Ω resistor

(e) Sketch the I – V characteristics for the filament of a lamp.

5a)i) What is *a Kilo-watt-hour*?

ii) Given that one unit of electricity costs shs.450. Calculate the cost of using the following appliances. 3kW kettle, 60W light bulb and a 3000W immersion heater for 6hours

b) Explain the observations made when:

(i) An ebonite rod is rubbed with fur.

(ii) Change leakage at sharply pointed conductors.

(c) i) With the aid of a diagram, describe the action of a simple cell.

ii) State any two advantages of a NiFe cell.

(iii) Explain the term local action and polarization as applied in cells

State how the above defects can be overcome

d) A cell of 6.0V e.m.f and negligible internal resistance is connected to a resistor and drives a current of 3.0A through it. Another cell of e.m.f 1.5V is inserted in the circuit in series with the first one. The current remains at 3.0A. What is the internal resistance of the second cell?

e) A moving coil galvanometer has a resistance of 40ohms and

gives a full scale deflection of 2mA.

(i) What is the P.D across its terminals when this current is flowing?

(ii) How can the galvanometer be converted into a voltmeter?

g) Explain why lead-acid accumulators are used in car batteries rather than dry cells.

h) Nickel-cadmium accumulators are used for emergencies lighting e.g. in hospitals rather than the lead acid accumulators. State the advantages of alkaline cell over the acid one.

6(a) What is *a simple cell*?

(b) when a bulb is connected between the two plates of a simple cell,the bulb lights up. However, the brightness of the bulb fades after about a minute.

(i) Explain why the bulb lights up.

(ii) Why does its brightness fall? How is the effect minimized in a dry cell?

c) i) Define the term *one ohm*.

ii) State the factors which affect the resistance of a conductor.

iii) State the factors upon which the resistance of conductors depends.

d) Why does the voltage of a cell across the terminals decreases when it is delivering a current?

e) Cells could be connected in series or parallel. Using usual symbols for cells show such connections for two cells.

(i) State one advantage of using the cells in series and one advantage for using them in parallel.

(ii) Would you expect two identical cells in parallel to drive more current through a resistor than one cell does?

(iii) Why do two identical cells in series drive more current through a resistor than one and why do they not double the current?

f)i) Identify four sources of mains in electricity

(ii) Electrical energy is distributed in all parts of Uganda by the national grid system which transmits a.c at very high voltage.

1-Explain why a very high voltage is necessary.

2-Why is an a.c and not a d.c used?

3-State the advantage the national grid has over the power station distributing power in the neighboring are directly.

g) Explain why:

(i) the cable in the power circuit thicker than that in a lighting circuit.

(ii) all the switches must be on the live wire .

(iii) the kWh is the unit of electrical energy for which consumers pay

7(a) Explain the cause of movement of a charge in an electric field.

(b) Derive an expression for the work done in moving a charge in an electric field.

(c) State the relationship between e.m.f, potential difference and lost voltage.

(d) How does the movement of the electrons through the wire generate heat?

(e) State the limitations of a dry cell for use in an electric circuit

(f) Describe the structure of a lead acid accumulator and explain how it works.

(g) Explain the working of the following electrical devices:

(i) Thermocouple

(ii) Photoelectric cell

(h) Distinguish between a primary a cell and a secondary cell. Give an account of each of them.

(I) Define the terms:

(i) Coulomb (ii) electrical resistance (iii) an ohm

8(a) What is *an electrolyte*?

(b) Explain in terms of the motions of the free electrons and the atoms inside a metal conductor why the resistance of the conductor rises as the temperature of the conductor increases.

(c) Draw sketch graphs of p.d V,against current,I,for the following:

(i) A wire

(ii) An electrolyte

(iii) A semi-conductor

(iv) Filament lamp

(v) Thermionic diode

(vi) Germanium diode

(d) Describe an experiment to measure the internal resistance of a cell.

(e) i) What is meant by *lost volts,terminal p.d and internal resistance*

(ii) An ammeter connected in series with a cell and 2 ohm resistor reads 0.5A. When the resistor is replaced by a 5ohm resistor, the ammeter drops to 0.25A. Calculate

(i) the internal resistance of the cell

(ii) the e.m.f of the cell.

(f) What is meant by electromotive force of a battery? Explain why the e.m.f sometimes falls below its normal value after the cell has been supplying current for a time.

9(a) What is meant by the terms:

(*i) A shunt?*

(ii) A multiplier?

(b)(i) Describe how a milliammeter reading 0-15mA with a 5-ohm resistance coil can be converted to a voltmeter of range 0-150V.

(ii) How can the above milliammeter be converted to an ammeter of reading the range of 0-3A.

(c) State the differences between a voltmeter and an ammeter.

(d)(i) Explain the safety precautions which must be taken when wiring a house.

(ii) Define *a kilowatt-hour*.

(iii) A house has one 100W bulb, two 75W bulbs and five 40W bulbs. Find the cost of having all these bulbs switched on for 2 hours every day at a cost of shs200per unit.

(e) Explain the principle of operation of a fluorescent tube or lamps.

(f)(i) Explain how electrical energy is transmitted over long distances.

(ii) State the advantages of transmitting power at high voltages.

(iii) Explain the energy changes in the process which begins with falling water at a power station and ends in a lamp in our homes.

(g) Give the advantages of alternating current over direct current in power transmission.

10(a)(i) What is *a transformer?*

(ii) Describe the structure and mode of operation of a transformer

(iii) Explain why transformer cores are made of iron.

(b) With the aid of a diagram, explain how a simple moving coil galvanometer works.

(c)(i) Draw a well labeled diagram of an electric motor.

(ii) Explain how the above motor works, and indicate the direction of rotation of the coil

(iii) State the ways in which the speed of rotation can be increased

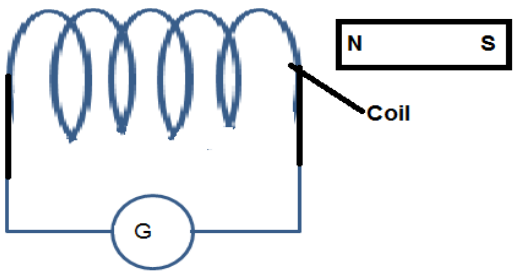
(d)(i) Explain the term *back e.m.f.*

(ii) Draw a well labelled diagram of a moving coil loud speaker, and explain how it works.

(iii) State the factors that affect the force on a current carrying conductor in a magnetic field.

(e) Describe how Fleming's left hand rule is use to predict the rotation of a rectangular carrying current placed in a Magnetic field.

11(a) A cable is connected to a centre- zero galvanometer, G, as shown in the figure below.



(i)State what is observed when the N pole of a bar magnet is moved towards the cable.

(ii)State two ways in which the effect observed in (a) (i) can be observed.

(b) (i) With the aid of a labelled diagram, describe how a simple a.c generator works.

(ii)Sketch the variation of the variation of the voltage from an a.c generator and use it to define the terms peak value and period.

(c) With the aid of labelled diagram, describe how full –wave rectified can be using four diodes.

(d) State any two factors which determine the magnitude of a force exerted on a current –carrying conductor.

(e)(i) With the aid of well-labelled diagram, describe the structure and mode of action of a d.c generator.

(ii) Sketch and explain the variation with time of the e.m.f generated by a d.c generator.

12(a) Distinguish between electrostatics and current electricity

(b) What is meant by:

(i) *Conductors?*

(ii) Insulators?

(c) Describe an experiment to show the existence of two types of charges

(d)(i) Draw a well labelled diagram of gold leaf electroscope

(ii) Describe an experiment to determine the use and sign of charge using a G.L.E.

(e) Explain how a G.L.E can be charged positively or negatively

(i) by induction

(ii) by friction

(f) Explain how a G.L.E can be charged positively and negatively by contact.

(g) Explain how an insulator gets charged by rubbing.

(h) State four uses of static electricity.

(i) Describe an experiment to test the insulating property of a material.

(j) Explain what happens when a negatively charged rod is brought near the cap of the electroscope and slowly taken away.

13(a) Explain what happens when a glass rod is rubbed with:

(i) Silk.

(ii) An identical glass rod.

(b) Describe how you would charge simultaneously two identical metal spheres either positively or negatively by induction.

(c) A polythene rod may be charged negatively by rubbing with a cloth but a brass rod held in the hand cannot.

(i) Explain what happens when the polythene is being rubbed.

(ii) Explain why the brass cannot be charged by rubbing.

(iii) What is meant by a conductor and an insulator? Give an example of each.

(d) Describe an experiment to charge a gold leaf positively by induction.

(e) Explain what happens when a negatively charged rod is brought near the cap of an uncharged electroscope and slowly taken away.

(f) Describe an experiment to test the charge on a charged body using a G.L.E.

14(a) Explain how a lightening conductor safeguards a houses against lightening

(b) Describe any one experiment to show that electric charge does not reside inside a hollow charged conductor.

(c) Describe how a charged rod can be discharged.

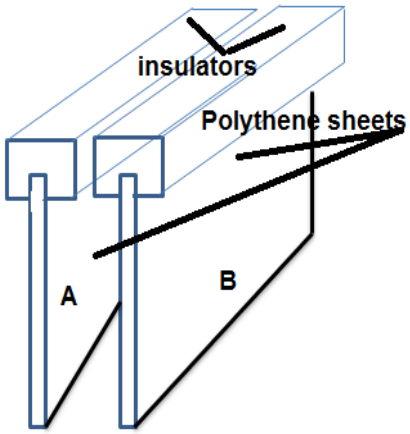
(d) What do you understand by *point action*?

(e) A Bunsen flame brought near the cap of charged electroscope causes the divergence of the leaf to become less. Explain this.

(f)(i) Explain why it is not advisable to touch the copper strip of a lightening conductor when it is raining.

(ii) Explain the action of a lightening conductor.

(g) Two polythene sheets A and B are both negatively charged with equal amounts of charge. One end of each polythene sheet is fixed into an insulator and the two sheets brought near each other as shown below.



(i) Describe and explain what happens.

(ii) Describe and explain what happens if an earthed sheet of metal is inserted between the polythene sheets without touching them.

(h) Explain how thunder is produced during a rainstorm.

15(a) Define the following terms:

(i) *An electric field*

(ii) An electric field lines.

(b) Sketch the electric field patterns for the following charge distributions:

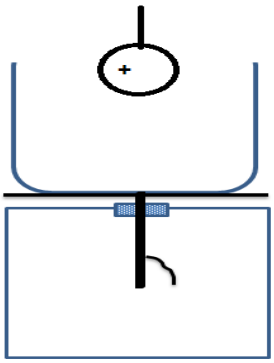
(i) Point positive and negative charges

(ii) Two equal like point charges

(iii) Two equal unlike point charges

(iv) Between a positively charged point and a plate between charged parallel plates.

(c) A positively charged metallic ball is held above a hollow conductor resting on the cap of a G.L.E as shown below.



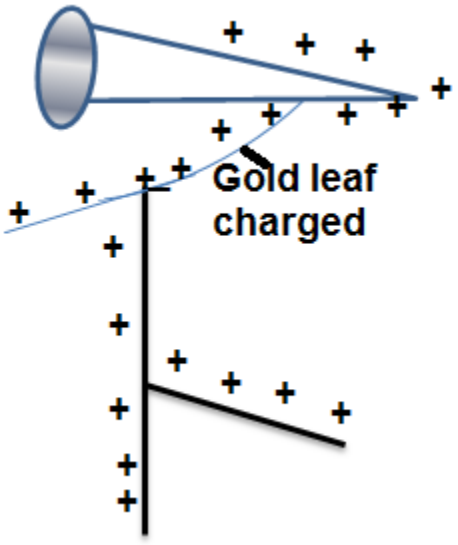
Explain what happens to the leaf of the electroscope as the ball is lowered into the conductor.

(d) What is *an electric field pattern*?

(e) Explain how distance between charged bodies very with force

between them

(f) The figure shows a sharp pin fixed on a cap of leaf electroscope. The electroscope is highly charged and then left for some-time.



Explain why the leaf collapses.

(g)(i) State the properties of electric field lines.

(ii) A positively charged rod is brought near the cap of a leaf electroscope. The cap is then earthed momentarily with the finger. Finally the rod is withdrawn. The electroscope is found to be negatively charged. Explain how this charge is acquired.

9. HEAT AND ITS EFFECTS

1(a) Define the following terms and state its S.I units

(i) *Heat*

(ii) Heat capacity

(iii) Specific heat capacity

(iv) Temperature

(b) State the factors which determine the quantity of heat of substance.

(c) Describe an experiment to measure the specific heat capacity of

a substance by method of mixtures.

(d) Calculate the quantity of heat required to raise the temperature of 500g of copper form 16^0 to 116^0. (Specific heat capacity of copper 490Jkg-^{1}K-^{1})

(e)(i) Distinguish between *boiling point of a liquid and evaporation*.

(ii) State the factors that affect the boiling point of a liquid

(f) Describe with the aid of a labelled diagram an experiment to show the effect of increase in pressure on the melting point of ice.

(g) State three factors which affect the rate of evaporation.

2(a) Define the following terms:

(i) Latent heat

(ii) Specific latent heat of fusion

(iii) Specific latent heat of evaporation

(iv) Melting

(v) latent heat of fusion

(vi) latent heat of evaporation

b)(i) Differentiate between *vaporization and boiling*.

(ii) State the factors which affect the rate of evaporation.

c) Describe an experiment to measure the specific latent heat of vaporization of steam.

d) A quantity of dry steam at 100^0C, weighing 0.003kg, was directed into a dry cavity of ice. The water produced from ice weighed

0.0027kg . If the specific latent heat of fusion of ice is 34000Jkg^{-1}.Find the specific latent heat of vaporization of water.

e) Explain using kinetic theory why evaporation causes cooling.

f)(i) Describe an experiment to measure the specific latent heat of fusion of ice.

(ii) State the possible sources of error in f(i) above.

(iii) Explain why latent heat of vaporization is always greater than of fusion.

g) Explain interms of molecules, what is a saturated vapour.

h) With the aid of labelled diagram describe how a refrigerator work.

3.(a) What is meant by *saturated vapour pressure.*

(b) Explain what may happen when one is to cook food from a very high altitude.

c) Use the kinetic theory to explain the occurrence of;

(i) Latent heat of fusion

(ii) Cooling by evaporation

d) The cooling system of a refrigerator extracts 0.7kW of heat. How long will it take to convert 500g of water at 20^{0}C into ice?

e) Explain the *concept of evaporation*.

f) A 180W heater and a thermometer were immersed in 0.5kg of water in a copper calorimeter. The following readings were

obtained;

Temp(^{0}C)	30	36	40	45	49	54	57
Time(min)	3	4	5	6	7	8	9

Plot a graph of temperature against time and use it to find;

(i) room temperature.

(ii) the specific heat capacity of water.

(iii) Give reasons why the value obtained for specific heat capacity is more the accepted value.

(iv) State two precautions you would take in carrying out this experiment to ensure a more accurate value for the specific heat capacity.

4.(a) Explain each of the following:

(i) Wet clothes dry more quickly on a warm day than on a cold day.

(ii) They dry more quickly on a windy day than on a still day.

(iii) They dry very slowly on a rainy day even if kept indoors.

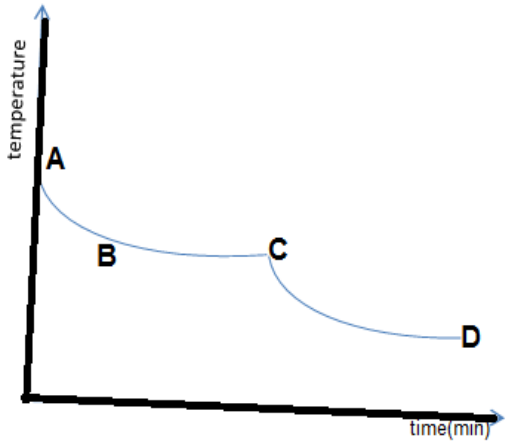
b) Describe the various observations which may be made if water in a beaker containing a thermometer is slowly until it boils. Hence, show the differences between evaporation and boiling. Some alcohol (b.p 78^{o}C) was heated in a flask and the temperature rose to 18^{0}C. There was then a large burst of vapour from alcohol and the temperature fell to 78^{o}C.

Explain these observations and state how the alcohol might have

been made to boil steadily at 78 °C.

(c) Water is introduced, drop by drop, into the space above the mercury in a barometer tube until a liquid film forms on the surface of the mercury. State and explain carefully what happens during this procedure

d) The graph in the figure shows a cooling curve of a liquid. Describe the main features of the curve.



(e) Describe one experiment to verify the statement that the saturation vapour pressure of water at the temperature at which water boils is equal to the atmospheric pressure.

5(a) What is meant by *thermal expansion*?

b) Describe an experiment to show that solids expand when heated.

c) State the effects of expansion in solids.

d) How are the effects in (c) above corrected?

e) Explain why;

(i) Gaps are often left between railway lines.

(ii) Metal bars feel cold when touched but not warm.

(ii) Glass cracks when hot water is poured into it.

f)i) Describe briefly the action of a bimetallic strip.

(ii) How is a bimetallic strip used in a thermostat?

(ii) How is a bimetallic thermometer work?

g)i) Describe an experiment to show that liquid expand when heated.

(ii) What is meant by an easy expansion of water?

(iii) Sketch graphs to show the variation of water volume and density against temperature.

h)i) Explain why fish is able to survive in water when the temperature of the surroundings is below the freezing point of water.

(ii) State the effects and applications of thermal expansion of liquids.

6.a) Explain the meaning of the following terms;

(i) Temperature

(ii) Fixed points

(iii) Absolute zero

(iv) Thermometric liquid

b) Describe a simple experiment to determine fixed points of a thermometer.

c) State six differences between mercury and alcohol as thermometric liquids.

d) Explain the mode of action of a clinical thermometer.

e)i) State the relationship between Celsius and thermodynamic scale of temperature.

(ii) Change the following;

- 500K into Celsius
- 27 degrees Celsius into kelvin.

(f) State four properties that make mercury suitable for use in a clinical thermometer.

(g) Explain why a clinical thermometer should not be sterilized in boiling water.

(h) Explain the importance of the following features of a liquid in glass thermometer.

(i) Thin walled bulb

(ii) A very fine bore

(iii) Thick walled stem with a bulge in glass down one side.

7(a) A hydrometer was placed in water at 1^0C, then water was warmed up to 10^0C.

(i) State the observation made on the hydrometer.

(ii) Explain your answer.

(b)i) State two ways in which the design of thermometers may be altered so as to increase its sensitivity.

(ii) State two reasons why water cannot be used as a thermometric

liquid.

(c)i) Explain why it is easier to remove a tight metal lid from a glass jar after running hot water over it.

(ii) State one advantage and one disadvantage of anomalous behavior of water.

(d)(i) State one instance when alcohol is suitable for measurement of temperature in thermometer and not mercury.

(ii) When a bulb of the thermometer is dipped in hot water there is a fall in the mercury level at the beginning and then mercury begins to rise. Explain this observation.

(e) In an ungraduated thermometer, the length of the mercury thread was 25mm when the thermometer was immersed in ice at 0^0C and 75mm in steam at 100^0C.

(i) What temperature in ^{0}C corresponds to the thread length of 65mm?

(ii) What change in thread length was produced when the temperature changed from 35^0C to 75^0C?

(f) Describe a simple experiment to calibrate unmarked mercury in glass thermometer, if no other thermometer is being used.

(g)(i) State three desirable physical properties of a thermometric liquid.

(ii) Mention two ways in which the design of a thermometer may be altered so as to increase its sensitivity.

8(a) State Boyle's law and explain how it can be verified.

(b) With the aid of a labelled diagram, describe an experiment to

show the relationship between the volume and pressure of a fixed mass of gas at constant temperature.

(c) Explain why a bubble of air increases in volume as it rises from the bottom of a pond to the surface.

(d) A mass of air is compressed air constant temperature from a volume of $500cm^3$ to a volume of $300cm^3$. If the initial pressure of the gas was 1oocmHg, what is the final pressure of the gas?

(e) What is meant by the term absolute zero of temperature?

(f) State Charles' law.

(g) With the aid of a labelled diagram, describe an experiment to show the relationship between the volume and temperature of a fixed mass of gas at atmospheric pressure.

(h)(i) State the kinetic theory of matter.

(ii) Using the kinetic theory, explain briefly, Boyle's law, Charles law and pressure law.

(I) Explain, using the kinetic theory of gases ,why the pressure of air inside the car tyre increases on a hot day.

(j) State pressure's law, and describe an experiment to verify the relationship between pressure and temperature of a fixed mass of gas at constant volume.

(k)(i) State the general gas equation.

(ii) Explain why it would be possible for pressure of the gas to be reduced to zero in practice.

(iii) A gas of volume $1000cm^3$ at a pressure of $4.0x10^5Pa$ and temperature of 17^0C is heated to 89.5^oC at a constant pressure.

Find the new volume of the gas.

9(a) Explain what happens when a liquid boils.

(b) What is meant by *dew point*?

(c) What do you understand by the terms:

(i) Saturated vapour

(ii) Unsaturated vapour

(iii) Boiling point.

(d) Describe a simple experiment to show that the boiling point of water is decreased by a reduction in pressure.

(e) Describe an experiment to measure the saturated vapour pressure of water at room temperature.

(f) Explain the greenhouse effect.

(g) Describe a simple experiment to show how the heat radiated from a hot object depends on the nature of the surface.

(h) Why are woolen materials bad conductors of heat?

10(a) Explain the following terms:

(i) Conduction

(ii) Convection

(iii) Radiation

(b) Describe briefly an experiment to illustrate each of the following.

(i) Water is a bad conductor of heat.

(ii) Copper is a better conductor of heat than iron

(iii) Convection current occur in gases

(iv) A rough surface is a better emitter of radiation than a polished surface

(c) Explain why a stone floor feels very cold to bare feet in winter, but a carpet in the same room feels comfortably warm.

(d) Draw a well labelled diagram of a domestic hot water system and explain its action.

(e) Explain the transfer of thermal energy by conduction and convection.

(f) A beaker of hot water is placed on a bench. Describe all the possible ways in which it loses heat and suggest ways of minimizing each.

(g)(i) Draw a well labelled diagram of a thermos flask and explain how it works.

(ii) State the possible ways upon which heat is lost in a vacuum flask.

(iii) State the ways how the above in (ii) can be minimized.

(h) Describe a simple experiment to show how the heat radiated from a hot object depends on the nature of the surface.

(I)(i) Give an account of the transfer of heat by conduction.

(ii) Briefly explain how the heat insulation of the windows of a house can be improved.

Give one other example of thermal insulation available for houses.

(j) Explain why, when the brakes of a moving car are applied for an appreciable time, they get hot.

(k) The tyre of a car when pumped up, the pump gets warm. Explain.

10. MAGNETISM AND ITS PROPERTIES

1(a) Explain the following terms based on magnetism:

(i) Magnetic field

(ii) Magnetic poles

(iii) Lines of force

(iv) Domains

(v) Neutral point

(vi) Paramagnetic material

(vii) Magnetic saturation

(viii) Magnetic meridian

(ix) Magnetic shielding

(x) Ferromagnetic materials.

(b) Explain the terms *magnetization and demagnetization* using domain theory

(c) Why does the ship get magnetized during the building process?¬

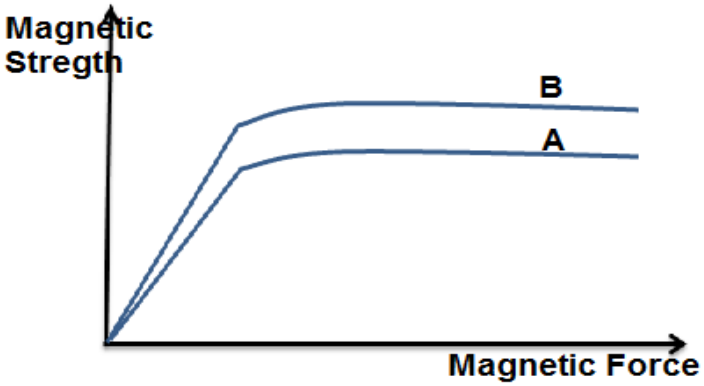
(d) Explain why a compass needle points in N-S direction.

(e) When a bar magnet is placed inside a solenoid carrying an alternating current, it loses its magnetism.

(i) What is the name given to this process?

(ii) Explain using domain theory how this process is achieved.

(f) The figure below represents graphs of magnetic strength against magnetic force obtained by magnetizing materials A and B.



(i) Explain the shapes of the graphs using domains theory

(ii) What material is likely to be hard magnetic material?

(iii) Which material can be used to make an electromagnet? Explain your answer.

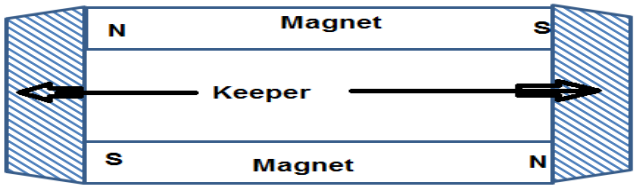
(g) Describe how an a.c voltage demagnetizes a bar magnet.

3(a) The figure below shows how two magnets are stored in pairs with keepers at the ends.

(i) Explain how the keeper keep the magnets from demagnetization.

(ii) Explain why soft iron keepers are suitable for storing magnets.

b) The diagram below hows a method of making a magnet.

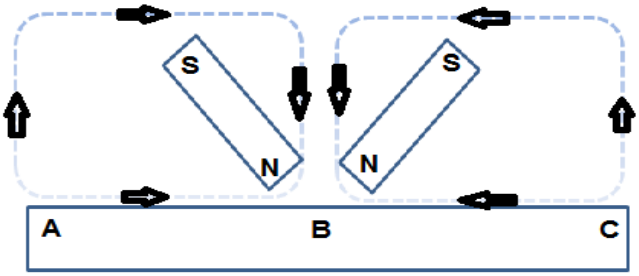


s

Indicate the poles at A, B and C.

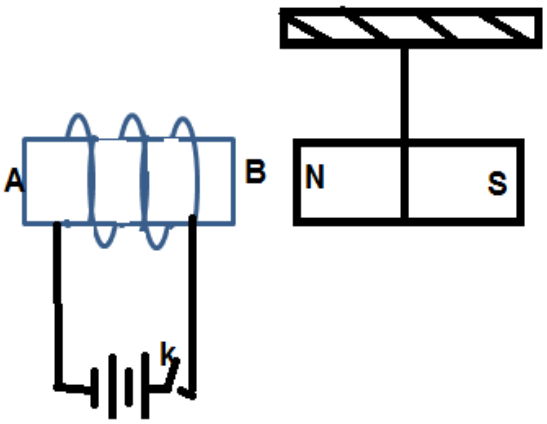
c) Two pins are attracted to a magnet as shown.

Name the poles X and Y.



d) The figure shows a soft iron AB placed in a coil and a bar magnet arranged with their length along a common axis.

State and explain what will be observed when switch K is closed.



(e) State and explain briefly the two properties of magnetism

(f)(i) Explain the meaning of the term magnetic shielding.

(ii) A certain wrist watch was labelled at the back “antimagnetic”. Explain by use of a diagram how the magnetic shielding is achieved.

(g)(i) Describe how an electric current may be used to demagnetize a steel bar.

(ii) Using domain theory of magnetism, explain why a magnet lose its magnetism on heating or hammering.

(h)(i) Describe how you would test for the polarity of a magnet.

(ii) Why is attraction as a method of testing for the polarity not considered a conclusive method?

4(a) State any four ways how a magnet can be take care.

(b)(i) Distinguish between magnetization and demagnetization of magnets.

(ii) State any three ways how the above in (b)(i) can be achieved.

(c) Explain how the single stroke and double stroke method of magnetizing magnets can be achieved.

(d) Describe the electrical method of magnetizing a bar magnet.

(e) State and explain then factors that affect the size of the force on a current carrying conductor in a magnetic field.

(f) State and explain three factors affecting the strength of an electromagnet.

(g) Explain with the aid of a diagram how the following works:

(i) An electric bell

(ii) A relay

(iii) An electric motor

(h)(i) State two advantages of a relay.

(ii) Mention four differences between soft iron and steel if used as an electromagnet.

5(a) Sketch the magnetic field pattern between the two poles of the magnet shown in the figure. The wire carrying current is in between the poles.

(b) Define the following terms

(i) *Magnetic field of a current carrying conductor*

(ii) Magnetic field line.

(c) With the aid of a well labelled diagram, describe the structure and mode of action of a moving coil loudspeaker.

(d)(i) Explain with the aid of a diagram, the mode of action and operation of a transformer.

(ii) State the sources of energy loses in a transformer, and how can they be minimized

(e). A transformer connected to 240V a.c mains is used to light a 12V 36W lamp.

(i) What current does the lamp need to light correctly?

(ii) If the efficiency of the transformer is 75%, what current is taken from the mains?

(iii) Calculate the magnitude of the series resistor that would be

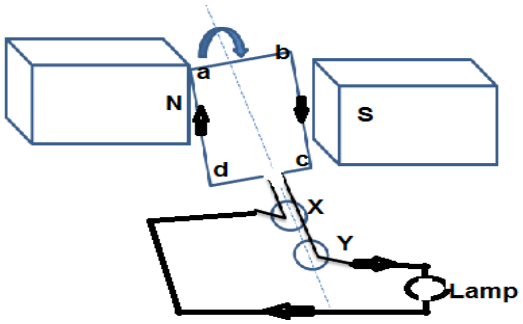
necessary if the lamp were connected directly to the mains.

(f)(i) Explain the term *electromagnetic induction*.

(ii) State and explain Faraday's and Lenz's law of electromagnetic induction. Describe how to demonstrate them.

(iii) With a sketch diagram, explain the use of the induction coil in cars' ignition system.

(g) The figure shows a simple a.c generator.



(i) Name the parts marked X and Y

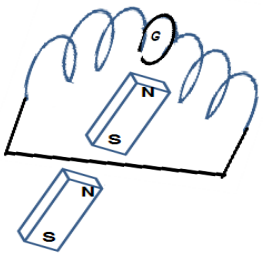
(ii) Explain why an e.m.f is produced between the ends of the coils when rotated.

(iii) Draw a sketch graph to show how the e.m.f between the ends of the coil varies with time over at least one revolution of time.

(iv) Draw a sketch graph showing what you would expect if the speed of rotation of the coil were doubled.

(v) What changes would you make in the above arrangement if a direct current is required in the outer circuit?

(h) A wire placed between the poles of two permanent magnets is connected to a galv



anometer

(i) State what is observed when the wire is moved up and down.

(ii) Suggest two ways of altering the magnitude of the effect you have stated in (i) above.

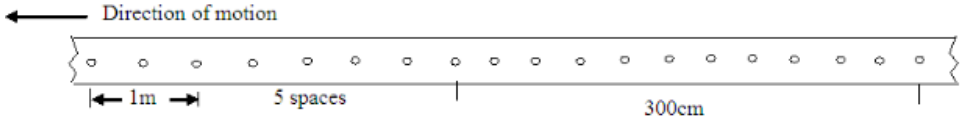
SET 2: RANDOMLY SELECTED QUESTIONS

1a) A car moving over a horizontal surface dose not continue with constant velocity when the accelerating force is removed. Instead it slows down and eventually stops.

i). Explain what causes the deceleration.

ii). Draw a labeled sketch diagram to show the forces associated with the car.

bi) The figure shows dots produced on a tape pulled through a ticker tape by a moving body. If the frequency o the tape is $50\ Hz$. Calculate the acceleration.



ii) Briefly explain how friction is compensated when a trolley is moving.

c) An electric train moves from rest with a uniform acceleration of $1.5\ ms^{-2}$ for the first $10\ s$ and continues accelerating at $0.5\ ms^{-2}$ for a further $20\ s$. It continues at constant speed for $90\ s$ and finally takes $30\ s$ to decelerate uniformly to rest.

i) Draw a velocity – time graph for the journey.

ii) Find the total distance covered.

iii) What is the average speed?

2a)i) What is meant by **acceleration due to gravity**?

ii) Describe an experiment to determine the acceleration due to gravity using a pendulum bob, retort stand and a stop clock.

iii) Give two reasons and explain why the acceleration due to gravity varies on the surface of the earth.

b) A train travelling at $72\ kmh^{-1}$ under goes a uniform retardation $2\ ms^{-2}$ when the brakes are applied. Find the time taken to come to rest and the distance travelled from the place the brakes were applied.

c) An object is dropped from a height of $20\ m$ above the ground with an initial velocity of $30\ ms^{-1}$. Find the time taken for the object to reach the ground.

d) State the energy changes that take place when a body held in your arm is dropped.

3a)i) What is meant by coefficient of linear expansion of a substance?

ii) Describe with the aid of a diagram an experiment to measure the coefficient of linear expansion of a solid substance.

iii) A metal rod has a length of $100\ cm$ at $200\ ^oC$, at what temperature will its length be $105\ cm$? (Linear expansivity of the material of the rod $0.00002\ K^{-1}$)

iv) Briefly describe any two useful applications of expansion of solids.

b)i) State the general gas equation.

ii) A balloon containing one litre of hydrogen at $27\ ^oC$ and $1.0\times10^5\ Pa$

pressure rises to a height where the pressure of gas is $0.8 \times 10^5\ Pa$ and the temperature is $15^o C$. What volume does the gas occupy now?

c) Explain why the kettle makes a hissing sound before the liquid begins to boil.

4a) What is meant by a **longitudinal wave** and a **Transverse wave**. Give an example each.

b) A water wave moves from deep to shallow water. What effect would this have on the frequency and wavelength? Illustrate with a simple diagram.

c)i) Define the term **Resonance**.

ii) Describe an experiment to determine the velocity of sound in air using an open-ended tube.

d) A vibrator in a ripple tank vibrates at $5\ Hz$. If the distance between 10 successive crests is $37.8\ cm$, calculate,

i) the wavelength of the wave.

ii) the velocity of the wave

e) Explain why open pipes are preferred to closed pipes in producing sound.

5a) Define **power** of a lens and state the S.1 unit.

b) Distinguish between a real image and a virtual image

c) A converging lens of focal length $20\ cm$ produces an upright image of an object which is magnified 4 times. Find by scale drawing:

i) the object distance from the lens.

ii) nature of image.

d) Describe how you would determine the focal length of a thin converging lens with the help of a plane mirror. Illustrate with a ray diagram.

e) State two applications of converging lenses.

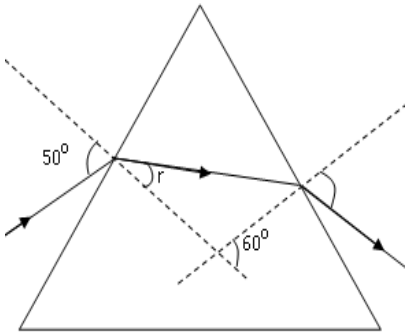
6a) What is meant by the following terms Critical angle and Total internal reflection?

ii) Give two conditions for total internal reflection to occur.

bi) Explain briefly how sky radio waves travel from a transmitting station to a receiver.

ci) Describe an experiment to determine the refractive index of a triangular glass block.

ii) The diagram below shows a ray of yellow light incident at an angle of 50^o on one side of an equilateral triangular glass prism of refractive index 1.52.



Calculate the angles marked r and e.

iii) State and explain what would be observed if the ray above was of white light.

7a) State two properties of electric field lines.

b) With the aid of diagrams, describe how two metal spheres may be charged by electrostatic induction.

c) Describe the mode of operation of a lightening conductor.

d) Draw electric field patterns for two parallel plates of

i) the same change.

ii) different changes.

e) Draw a labeled diagram of gold leaf electroscope and give any 4 uses.

8a) Define **heat capacity** and **specific heat capacity** of a substance.

b) Describe an experiment to measure the specific heat capacity of water.

c) An electrical kettle rated at $2.25\,kW$ takes $2.5\,\text{min}$ to raise the temperature of $0.80\,kg$ of water by $80\,^{o}C$. Calculate:

i) The heat produced by the kettle in this time.

ii) Heat absorbed by water

iii) Suggest one reason for the difference in these readings.

iv) If the heater is operated for a further $100\,s$, it is found that $0.1kg$ of water is converted to steam. Calculate the specific latent heat of steam.

d)i) Explain:

i) why boiling causes evaporation.

ii) why a porous pot cools water more effectively than a kettle.

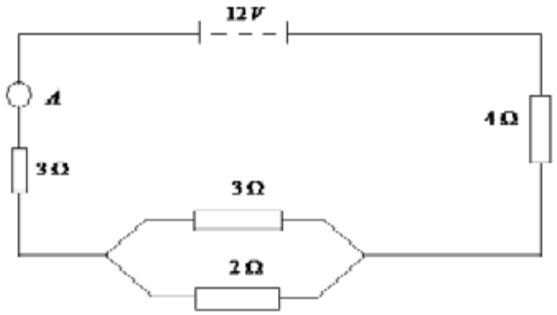
9a)i) Distinguish between a primary cell and a secondary cell.

ii) Mention four ways of caring and maintaining a secondary cell.

b)i) Draw a well labeled diagram of a dry (Leclanch'e) cell.

ii) How is polarization overcome in a dry cell?

c) Four resistors are connected across a $12\ V$ battery, of negligible internal resistance as shown in the figure below.



i) Determine the reading of the ammeter A.

ii) the p.d across the parallel combination of resistors.

d) Name one instrument that turns chemical energy to electrical energy.

10a) State the **law of floatation** and **Archimedes' principle**.

b) Describe an experiment to measure the density of an irregular solid that floats in water.

c) A block of wood of mass $24\,kg$ floats in water and the block has a total volume of $0.032\ m^3$. Find:

i) the volume of the block below the surface of water.

ii) the density of the wood.

d)i) A hollow metal sphere of mass $5\,kg$ is tied to the bottom of the sea-bed by a rope. The tension in the rope is $60\ N$. Calculate the volume of the sphere.(Density of sea water = $1100\ kg\ m^{-3}$).

ii) Explain why ships float yet they are made from steel and iron which are denser.

iii) What are the uses of primsol lines?

e) Smoke is confined in an illuminated cell and is observed through a microscope. State what is observed when:

i) The temperature is increased.

ii) When cold water is poured on the cell.

11a) What are the advantages of alternating current over direct current?

b) Describe with the aid of a diagram, the construction and action of a transformer.

c) A transformer is designed to operate at $240\,V$ mains supply and deliver $9V$. The current drawn from the mains supply is $1.0\,A$. if the efficiency of the transformer is 90%, calculate:

i) the maximum output current.

ii) the power loss.

d) State 3 possible causes of the power loss in (c ii) above and state how the power loss is minimized.

e) A $240\,V$ mains transformer has 100 turns in primary and N turns in the secondary. It is used to supply energy to a $12\,V/24\,W$ lamp.

i) How many turns are there in the secondary coil?

ii) What is the efficiency of the transformer if the current drawn from the $240\,V$ supply is $125\,mA$?

13a) With a clear diagram, explain the mode of operation of a refrigerator.

b(i) What is meant by latent heat of evaporation and latent heat of fusion.

ii) Describe an experiment to determine latent heat of vaporization.

c) The cooling system of a refrigerator extracts $0.7\,kW$ of heat. How long will it take to convert $500\,g$ of water at $20^{o}C$ into ice?

d) A copper block of mass $0.68\,kg$ is suspended in a freezing mixture at $-50^{o}C$ for some time and then transferred to a large volume of

water at $0^{o}C$. A layer of ice is formed on the block.

i) Explain why the ice is formed

ii) What will be the temperature of the copper after this change is complete?

iii) Calculate the mass of the ice formed?

e) Steam at $100^{o}C$ was passed into $200\ g$ of cold water at $8^{o}C$ until its temperature rose to $100^{o}C$. Calculate the mass of the steam that condensed to form

warm the water, if no heat was lost during the operation. (s.h.c of water = $4200\ J\ kg^{-1}K^{-1}$ and specific latent heat of vaporization of water = $2.3\times10^{6}\ J\ K^{-1}$)

14a) Define the term magnetic field.

b) Draw a diagram to show the magnetic field pattern around the wire carrying current placed near another wire carrying current in the same direction.

c)i) What is an electromagnet.

ii) Describe with the aid of a labeled diagram how an electric bell works.

d)i) Explain how an iron bar can be magnetized by electrical method.(4)

ii) Explain why a magnet loss its magnetism when placed in a coil of wire carrying an alternating current.

15a) Define the following terms as used in machines.

i) Mechanical advantage ii) Velocity ratio

iii) Efficiency

b)i) Give two reasons why machines are never efficient.

ii) How can one improve on the efficiency of a machine?

c) Describe an experiment to investigate how the efficiency of a block and tackle pulley system varies with the load it is used to lift. What results would you expect from the experiment?

d) A block and tackle pulley system with a velocity ratio of 5 and 60% efficiency is used to lift a load of mass $60\ kg$ through a vertical height of $2\ m$.

i) What effort must be exerted?

ii) How much work is done in lifting the load?

iii) How much energy is wasted? Give one reason.

16a)i) Draw a labeled ray diagram to show the formation of an image in a pinhole camera.

b) State the effect on the image in a pinhole camera
i) Enlarging the pinhole.

ii) Decreasing the distance between the pinhole and the screen.

c) Explain the phenomena of dispersion as applied to white light.

ii) Draw a ray diagram to show how a pure spectrum may be obtained.

iii) Distinguish between secondary and primary colour. Give one example of each.

d) Name the colour that would be obtained when the following coloured lights are mixed;

i) green and red

ii) cyan and red.

c) Explain why an object illuminated by white light appears;

i) coloured

ii) Black.

17a) Define the following:

(i) moment of a force about a point,

(ii) centre of gravity of a body.

b)i) State the principle of moments.

ii) Describe an experiment to determine the mass of a metre rule.

iii) A uniform beam AB, 4m long and mass 50kg rests horizontally on two supports placed 0.5m from A and B respectively. The beam carries a load of 75kg at a distance of 1.5m from A. Find the reactions at the supports. How far must the support near B be moved in order to make the reactions at the supports equal.

cii) State the law of conservation of linear momentum.

d) A bullet of mass 20g is fired into a block of wood of mass 400g lying on a smooth horizontal surface. If the bullet and the wood move together with speed of $20ms^{-1}$, calculate:

i) the speed with which the bullet hits the wood.

ii) the kinetic energy lost.

Examination SET 3

1. a) State Newton's law of inertia and use it to define force.

b) i)State the laws of conservation of linear momentum ,and what is linear momentum?

ii) A shell of mass 40g is fired at a velocity of 800ms-^{1} from a gun of mass 800g .calculate the recoil velocity of the gun.

c)i) Define centre of gravity

ii) Describe how you would determine the centre of gravity of a flat irregularly shaped piece of card board

iii) Explain why a lorry is more likely to topple over when the roof rack is heavily loaded than when the roof rack is empty.

d) i) State Archimedes' principle.

ii) A balloon filled with air weighs 1g and it has a gas capacity of 2m^{3}.the gas in the balloon has density of 100gcm$^{-3.}$ If the density of air is 1300gcm^{-3} calculate the resultant force on the balloon when it is floating in air. Draw a diagram showing the forces acting on it if the balloon is suspended in air, held by a string.

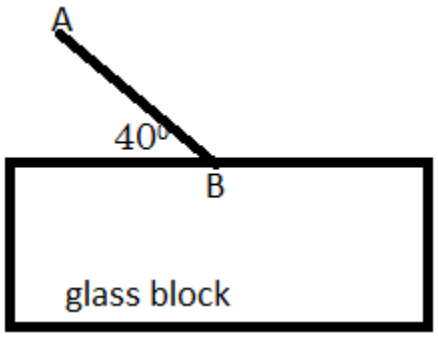
2. a)i) Define critical angle.

ii) Explain the term total internal reflection, and state two conditions for total internal reflection of light to occur

b) The frequency of a ray of light is 6.0 x 10^{14}HZ and the speed of light in air is 3.0 x 10^{8} $^{ms-1}$ .the refractive index of the glass is 1.5.

i) Explain the meaning of the term refractive index?

ii) What is the wavelength of the light in air to glass?



iii) Through what angle is the ray AB in figure deviated when entering the block at B

iv) What is the angle of incidence at the lower face of the block?

v) How could the answers to in (ii) and (iii) be changed if a ray of lower frequency were substituted for the original ray? In each case state your reason.

c) Describe how you would determine the focal length of a converging lens using an illuminated object and a plane mirror.

c) i) Distinguish between secondary and primary colors. Give one example of each.

ii) Explain the appearance of a red –tie with blue spots when observed in a red light.

3 a) Define specific latent heat of fusion, and state its S.I units.

b) Describe an experiment to determine the specific latent heat of fusion of ice.

c) A copper block of mass 300g is heated to temperature of 245 ^{o} c and when then dropped into a well lagged calorimeter of mass 350g containing 400g of water at 35 ^{0}c. calculate the maximum temperature attained by the water.

d) i) Differentiate between boiling and evaporation

ii) Briefly explain how a vacuum flask can keep cold liquids cold.

4 a) State pascal's principle, and name three instances where pascal's principle is applied.

b) i) Show that the pressure P at a point in a liquid of density ρ at height h is given by P=hρg.

ii) In a hydraulic press, the surface areas of the pistons are 5.0×10^{-4} m^2 and

$3.0 \times 10^{-2} m^2$ respectively. If the smaller piston is pushed down with a force of 150.

Calculate the force with which the larger piston moves up.

c) Briefly describe how a hydraulic car brakes works.

d) i) Differentiate between a strut and a tie.

ii) A wire 1.0m long and of cross sectional area $2.0 \times 10^{8} m^2$ is acted upon by a tensile force of 50N and an extension of 1.2mm occurs. Calculate the tensile stress.

5 a)i) Differentiate between electromotive force and potential difference

ii) Give two advantages of connecting bulbs in parallel to a battery

b)i) State ohm's law, and all the necessary conditions

ii) Describe how you would investigate the relationship between current flowing through a metallic conductor and the p.d across its ends.

b) Find the current in a circuit when a charge of 40 coulombs passes in 5 seconds.

c) Explain how a gold leaf electroscope can be charged positively by induction.

d) A moving coil galvanometer has a resistance of 5 ohms and will give a full scale deflection when a current of 0.015A flows through it. Calculate the value of the resistance which would convert the meter into an ammeter reading to up 3A.

6 a) Explain what is meant by mutual induction.

b)i) Describe the mode of operation of a step up transformer.

ii) Mention the causes of energy losses in a transformer and state how they can be minimized.

c) A transformer with 400 turns on the primary coil and 200 turns on the secondary is designed to step down voltage from 240V. If current in the primary and secondary coil is 4A and 5A respectively. Calculate the efficiency of the transformer.

8. (a) What do you understand by the following terms as applied to motion:

(i) uniform velocity

(ii) acceleration

(b) The table below shows the variation of velocity with time for a body which

has been thrown vertically upwards from the surface of a planet.

Time/s	0	1	2	3	4	5

Velocity/ms^{-1}	8	6	4	2	0	-2

(i) What does negative velocity mean?

(ii) Plot a graph of velocity against time

(iii) Use the graph in b(ii) to find acceleration due to gravity on the planet.

(iv) Use the graph in b(ii) to calculate total distance travelled

(v) If the body weighs 34N on earth, what is its weight on the planet?

9. (a) Define the term specific latent heat of vaporization.

(b)i) Describe an experiment to determine specific latent heat of vaporization of steam.

Why is a thermometer not used in the experiment?

ii) List all the measurements you would take in order to calculate the value for the energy supplied by the heater and the specific latent heat of vaporization .show how you would use the vales.

iii) Once the water was boiling steadily, the following readings were made in a period of two minutes when energy supplied by a 100W immersion heater.

Mass at start of the 2min. period=310.4g

Mass at end of the 2min.period=305.9g

Calculate the specific latent heat of vaporization of water.

(c) A copper container of heat capacity $60Jkg^{-1}$ contains 0.5kg of water

at

20^0C. Dry steam is passed into the water until the temperature of the container and the water reaches 50^0C. Calculate the mass of steam condensed. (Specific latent heat of vaporization of steam = 2.26 x 10^6Jkg^{-1})

. (d) (i) What is meant by saturated vapor pressure?

(ii) Explain what may happen when one is to cook food from a very high altitude.

10. (a) Define the terms:

(i) Surface tension

(ii) Cohesion force

(b) A solution is made by dissolving 1cm³ of cooking oil in 199cm³ of methanol. When 0.004cm³ of the solution is dropped on the surface of water, an oil film of diameter 12cm is obtained.

(i) Estimate the thickness of a molecule of the cooking oil.

(ii) State any assumption made in b(i) above.

(c) Smoke confined in an illuminated cell is observed through a microscope.

(i) State what is observed.

(ii) What conclusions can be drawn from the observations in c(i) above.

d) Using the kinetic theory, give explanations for each of the

following.

i) It is necessary to supply energy to change water to steam at 100^{o}c

ii) Dust particles floating in still air appear to jog about.

11. (a) Define half-life of a radioactive substance.

b) The mass of a radioactive substance decays to a $\frac{1}{16}th$ of its original mass after 16 days. Calculate:

(i) its half-life

(ii) the fraction of the original mass will have decayed after 20days.

(c) $^{232}_{90}X$ $^{228}_{88}Y$ $^{228}_{89}Z$ $^{228}_{89}Z$

(i) Identify the particles or radiations A, B and C emitted in the decay process above.

(ii) State two differences between radiations A and B.

(iii) Name two health hazards of radioactivity.

d) Differentiate between nuclear fusion and nuclear fission.

12. (a) Define the following terms as applied to a convex lens:

(i) focal length

(ii) power

(b) An object is placed 10cm in front of a convex lens of magnification 3.

Determine the:

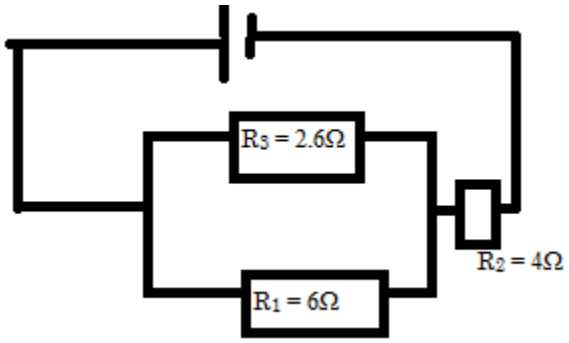
(i) distance of the image

(ii) focal length of the lens

(c) Describe a simple experiment to determine the focal length of a convex lens.

(d) Write down two practical applications of convex lenses.

14. (a) A battery of e.m.f 10V and negligible internal resistance is connected to three resistors R_1, R_2 and R_3 resistances 6Ω, 4Ω and 2.6Ω respectively shown in figure.



(i) Calculate the effective resistance of the circuit.

(ii) Find the rate at which the electrical energy is converted to heat energy in R_3.

iii) Total power dissipated in the resistors

(b) (i) Define the term internal resistance.

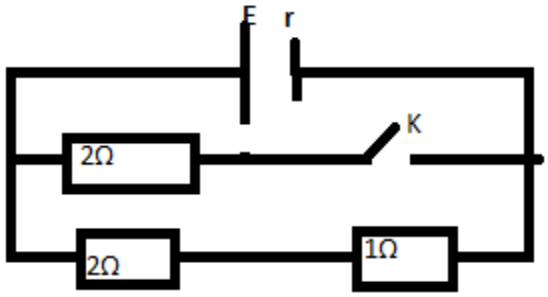
(ii) What is an ohmic conductor?

(iii) Give three examples of non ohmic conductors.

Sketch two current-voltage characteristic for non ohmic devices.

(c) Describe an experiment to measure the internal resistance of a cell.

d(i) Define the terms e.m.f and internal resistance



ii) The figure above is circuit diagram with switch K cell X and three

resistors as shown in figure. When K is open the current is 5A and when K is closed the current is 4A. Determine the e.m.f, E and internal resistance r of cell X.

15. (a)(i) Define the term Electrostatics.

(ii) State the laws of electrostatics.

(b) What is meant by electric field? Sketch the electric field partners of the following:

(i) Isolated plates

(ii) Unlike parallel plates.

(c) (i) Draw a well labeled diagram of gold leaf electroscope.

(ii) Describe how an electroscope can be changed positively by induction

iii) Explain why small pieces of paper are first attracted towards a glass rod rubbed with silk but they immediately move away.

iv) In terms of electron concept, explain how positively and negatively charged objects are distinguished.

(d)i) Describe how a lighting conductor works?

ii) Explain the term corona discharge

e) (i) Define the term Capacitance

(ii) State the factors that affect the capacitance of a capacitor.

iii) State three ways by which the capacitance of the capacitor may be

increased.

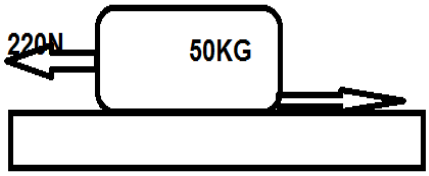
f) A metal plate is held over a charged electroscope and the leaf collapses.

i) Why does the leaf collapse?

ii) What has happened to the capacitance of the electroscope?

16. (a) State Newton's Laws of motion.

(b) A block of mass 50kg is pulled from rest along a horizontal surface by a rope tied to the face of the block as shown. The tension in the rope is 220N.



The frictional force between the block and the horizontal surface is 120N.

(i) Find the acceleration of the block.

(ii) Calculate the distance moved by the block in 4.0seconds.

(iii) What is the reaction of the surface on the block?

(iv) Compare the work done by the tension in the rope during the 4.0 second interval with kinetic energy gained.

17. (a)i) What is meant by a pascal?

ii) Describe an experiment to show that pressure in a liquid increases with depth

iii) Describe how a manometer is used to measure gas pressure.

(b) (i) Explain why one feels more pain when pricked with a needle than when pricked by a nail?

(ii) State assumption made above.

(c) With the aid of a labeled diagram, explain how a lift pump works.

(d) Calculate the pressure exerted on the ground by a box of mass 10kg when corresponding area of contact is $2m^2$.

18.(a) Define the following terms:

(i) Mechanical Advantage

(ii) Velocity Ratio

(iii) Efficiency

(b) A load of 450N is raised through a vertical distance of 1.5m by a pulley system. If the velocity ratio of the system is 4 and the efficiency is 75%, calculate;

vi) the mechanical advantage

ii) the effort

iii) the useful work done by the machine

(c) Describe an experiment to determine how the mechanical advantage and efficiency of the block and tackle pulley system varies with the load.

(d) Give two practical applications where pulleys are used.

19. (a) Explain the real, virtual images as applied to optics.

(b)i) With the aid of a ray diagram, explain why a convex mirror is used as a driving mirror.

(ii) An object is placed 15cm in front of a concave mirror. An upright image of magnification 4 is produced. Determine the

(I) nature of the image

(II) focal length of the mirror

III) distance of the image from the mirror.

(c)i) Name two applications of a concave mirror.

ii) Distinguish between refraction and dispersion as applied to optical instruments.

(d)i) A coin placed at the bottom of a beaker 8cm tall and is filled with a

liquid X. If the refractive index of liquid X is $\frac{5}{3}$, find the apparent depth of the coin.

(ii) State any one use of triangular glass prism.

20 (a) State the kinetic theory of matter.

(b) (i) State Charles' Law

(ii) The volume of a fixed mass of gas at a given pressure is 1.5m³ at 300k.

At what temperature will the volume of the gas be 0.5m³ at the same pressure?

(c) Describe an experiment to verify Charles' Law. Use of relevant diagrams is required.

(d) (i) The fundamental interval of mercury in glass is 192mm. Find the temperature in degrees Celsius when mercury thread is 67.2mm long.

(ii) State one physical property which changes with temperature.

21 (a)i) What is meant by concrete?

(ii) Name three constituents of concrete materials.

(b)i) Name any two characteristics of concrete which make it good building material.

(ii) Name any two ways in which concrete may be reinforced.

(c)i) State the principle of flotation.

(ii) When a ship sails from fresh water into the sea, does it sink deeper into the water or rise out of it? Explain why this is so?

d) Describe an experiment to verify Archimedes' Principle.

(e) (i) Distinguish between the density and relative density of a substance. State the units in which density and relative density may be quoted.

(ii) A piece of glass weights 0.5N in air and 0.3N in water. Calculate the relative density of the glass.

22. (a) Define: (i) displacement (ii) Momentum

(iii) Inertia of a body. And state units of each.

(b) A passenger in a fast moving bus hit his head on the front seat when the driver suddenly applied brakes. Explain why this happened.

(c) (i) Briefly describe an experiment to measure the density of an irregular solid such as a glass stopper?

(ii) A pile of 500sheets of paper has a mass of 2000g. The pile is 300mm long, 200mm wide and 50mmthick.

Calculate (i) the thickness of one sheet (ii) the mass of one sheet, (iii) the density of the paper.

23 (a) Define Pressure and state its S.I Unit.

(b) (i) Outline the factors which affect pressure in a liquid.

(ii) Water is poured in a cylindrical container up to a height of 0.5m.

If the base of the container is circular and has a radius of 0.2m, find the force the water exerts at the base.

(c) Peter screamed in pain when her sister of mass 55kg accidentally stepped on his foot when wearing high heeled shoes. Peter claimed the pressure her sister exerted on him was greater than that he would experience if stepped on by an elephant of mass 1 tonne. Determine if Peter's claim is true given that the heel of her sister's shoe is $0.8cm^2$ while the average are oaf an elephant's foot is $400cm^2$

26 (a) Define the following terms:

(i) Joule

(ii) A Newton

(iii) moment of force

(b) A bullet of mass 20g is fired into a block of wood of mass 400g lying on a smooth horizontal surface. If the bullet and the wood move together with a speed of 20ms-1, Calculate:

(i) The speed with which the bullet hits the wood.

(ii) The kinetic energy lost.

(c) Sketch a velocity-time graph showing:

(i) Uniform velocity (ii) uniform acceleration

(d) A car initially at rest moves with uniform acceleration for 20seconds attaining

a velocity of $15ms^{-1}$. It maintains that velocity for a further one minute before finally coming to rest after being retarded uniformly for 10seconds.

(i) Draw a sketch of velocity-time graph to show the motion of the car above.

(ii) Calculate the total distance traveled.

(iii) Calculate the retardation.

. (e) (i) State two uses of friction.

(ii) List three ways of minimizing friction.

27. (a) What is meant by:

(i) Bimetallic strip

(ii) Linear Expansivity

(b) An iron rod measures 200cm at 10ºC. At what temperature is its length 200.6cm? [Linear expansivity of iron = $1.2 \times 10^{-6} K^{-1}$]

(c) Sketch a graph to show how:

(i) Volume varies with temperature

(ii) Density varies with temperature

(d) (i) Describe a simple experiment to verify Boyle's Law.

(ii) The volume of a fixed mass of a gas at constant temperature is $150cm^3$when the pressure 76cmHg. Calculate the volume when pressure is 19cmHg.

28 (a) Differentiate between:

(i) Conduction and convection.

(ii) a saturated vapor and unsaturated vapor.

(b) Describe an experiment which can be performed to show convection in a liquid.

(c) (i) Draw a labeled diagram of a vacuum flask ,and explain the functions of each part.

(ii) Explain how a vacuum flask minimizes heat losses.

(d) Explain the following:

(i) On a cold day a bar of iron feels colder than a plastic cup

(ii) On a cold night condensation takes place on the inside of the windows of a car.

29 (a) Define the following terms as applied to concave:

(i) Focal length

(ii) Centre of curvature

(b) Describe an experiment to determine the focal length of a concave mirror

(c) Give two reasons why convex mirrors are commonly used as driving mirror

(d) (i) A concave mirror of radius of curvature 10cm has a real object placed

9cm from the reflecting surface. Determine the position of the image.

(ii) Why are parabolic mirrors preferred in head lamps?

30 a) Giving two examples for each distinguish between primary and secondary cells

b) A cell of e.m.f 2V and negligible internal resistance is connected to two resistors of value 4ohms which arte connected (i) in series (ii) in parallel. Find the total current drawn from the cell and the current in each resistor in each case.

c)i) State ohm's law

ii) Describe how ohms law can be verified

iii) Define the term one ohm resistance. State the factors which affect the resistance of a conductor.

iv) State the factors upon which the resistance of conductors depends

d)i) State and explain the unit of electrical energy for which consumers pay.

ii) An electric iron is marked *500W 250V* .explain what this means.

Find (i) the current drawn from 250V mains (ii) the resistance of the heater

iii) The energy dissipated when the iron is used for 30 minutes each day in a month of 30 days and

(iv) The cost of using the iron at cost of sh 5.20per unit

31a) i) state the law of magnetism

ii) State what you understand by the terms magnetic field and magnetic lines of force.

b) Two bar magnets are placed on a horizontal table with (i) their N-poles facing each other

ii) The N-pole of facing the S-pole of the other. Sketch the lines of force between them

c)Explain why (i) the strength of a magnet cannot be increased beyond a certain limit

(ii) An increase in temperature weakens or destroys the magnetism of a magnet.

d) i) State there procedures which could create a magnet from a length of magnetic material. Identify the polarity developed at both ends in each case.

ii) State two ways of demagnetizing a magnet.

32 a)i) What is meant by a step up transformer?

ii) Why does a transformer work with ac only?

iii) What is the purpose of a soft iron core in a transformer?

iv) State the four ways in which power is lost in a transformer. How can the power loss be minimized in each case?

b) Why is the e.m.f produced at a power station stepped up to a high voltage for a long distance transmission?

c) Calculators work on 6V d.c. Explain how they are adapted to work by drawing power form the mains.

d) i) A 240V mains transformer has 1000turns in a primary and N turns in the secondary. It is used to supply energy to a 12V/24W lamp. How many turns are there in the secondary coil?

ii) What is the efficiency of the transformer if the current drawn from the 240V supply is 125mA?

33(a(i) Define center of gravity.

ii) State two factors which affect the stability of a body.

b) Describe an experiment to determine the Centre of gravity of an non uniform lamina.

c) Explain why buses should carry heavy luggage in compartment situated in the lower parts instead of the roof racks.

d (i) What is meant by stability of a body?

(ii) State and explain the state of equilibrium with illustrations.

iii) State any 3 application of stability.

e) A bottle containing soda stands on a bench.

As the temperature of surrounding rises the temperature of the soda in bottle rises. Explain the effect on the stability of the bottle.

(f)i) Define moment of a force and state its units

ii) State the principle of moments.

iii) State three factors which affect the moment of a force.

iv) What are the necessary conditions for a body to be in equilibrium?

34(a)i) The handle of door is near its outside edge. Explain why it is so?

ii) Describe an experiment to determine the weight of abeam using the principle of moment.

(b) Using a known mass M, explain how the principle of moments is used to determine the mass of unknown body.

(c) State any practical application of turning effect of forces.

d)Define the term:

i) Couple

ii) Torque

e)i) State the effect of a couple.

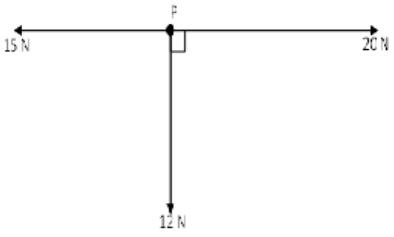
ii) State the relationship between the position of the Centre of gravity and stability.

f) A uniform rod 120cm long has weight 2N and 0.2N hanging from its ends and their balances when supported at a point 20cm from the larger weight. What is the weight of the rod?

SAMPLE SPECIMEN EXAMINATION PAPER
535/2 **PHYSICS**
Paper 2
Time 2h 15 min.
INSTRUCTIONS TO CANDIDATES:
Answer only Five Questions
Where necessary use;

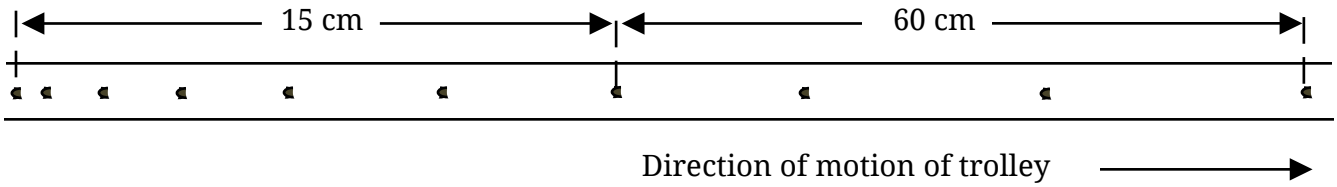
Acceleration due to gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Density of water	=	1000 kg m^{-3}
Speed of sound in air	=	320 m s^{-1}

1. a) State Newton's laws of motion.
(3marks)
b) Three forces act on a particle P of mass 2 kg, as shown below:
Find
(i) the resultant force on the particle.



(ii) the distance covered by the particle in 5 seconds before coming to rest.

c) The following tape shows dots made by a ticker tape timer vibrating at a frequency of 50 Hz when it is pulled by a trolley.



(i) State whether the trolley is accelerating.

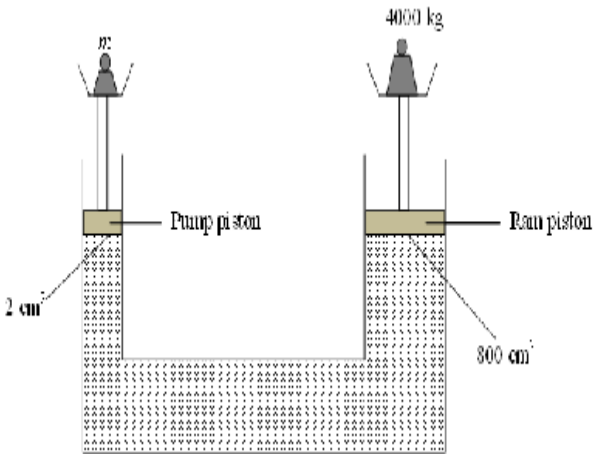
(ii) Find the acceleration of the body.

2. a) Define pressure.

b) Show that the pressure at a point in a liquid of density ρ below the surface of the liquid at a depth h is given by $P = \rho g h$, where g is the acceleration due to gravity.

c) (i) State Pascal's principle.

(ii) The figure below shows a hydraulic press in action.



Given that the pump piston has an area of 2 cm^2 and the ram piston an area of 800 cm^2, calculate the value of m required to overcome a load mass 4000 kg.

d)(i) What is atmospheric pressure?

(ii) Describe an experiment to show the action of atmospheric pressure.

3. a)Define the *specific heat capacity* of a substance. (1mark)

b)A bath contains 100 kg of water at 60^0C. Hot and cold water taps are then turned on to deliver 20 kg per minute each at temperatures of 70^0C and 10^0C respectively. How long will it take for the temperature of the bath to drop to 45^0C? Assume complete mixing of the water and ignore heat losses. (8marks)

c) (i) A piece of ice at a temperature of -10^0C is heated to a temperature of 50^0C. Sketch a graph of density against temperature to show the changes that take place. (3marks)

(ii) State one biological importance of the anomalous behaviour of water. (2marks)

d) State two advantages of the high specific heat capacity of water.

4. a) Define the following terms

(i) *Electrical power*. (1 mark)

(ii) the *kilowatt-hour*. (1 mark)

b) Electrical power of 800 kW is transmitted through cables of total resistance 10 Ω at a p.d of 11 kV to a factory which requires 415 V.

(i) Determine the current in the transmission lines. (2marks)

(ii) Calculate the power loss in the transmission lines. (2marks)

(iii) What happens when the power is transmitted at 415 V? (2 marks)

c) Explain the functions of the following devices iv a domestic

house wiring or electrical installation:

(i) the fuse. (2 marks)

(ii) the earth wire. (2 marks)

d) A 2 kW electric fire is used for 10 hours each week and a 100 W lamp is used for 10 hours each day. Calculate the cost of using these appliances for a week if 1 kWh costs sh. 200/=. (3marks)

e) State two advantages of having parallel circuits and connections of appliances over series connections. (1 mark)

5. a) State Archimedes' principal. (1 mark)

b) (i) Describe an experiment to verify Archimedes' principal.(5mks)

(ii) A string supports a solid block of mass 1 kg and density 9000 kg m^{-3}, which is completely immersed in water. Calculate the tension in the string. (3marks)

c) Explain the importance of plimsoll lines on cargo ship. (2mks)

d) A small steel ball is allowed to fall centrally down a tall cylinder containing lubricating oil.

(i) Sketch the velocity-time graph for the motion of the ball.(2mks)

(ii)Describe the features of the graph. (3marks)

6. a) Define as applied to a convex lens;

(i) Principal focus. (1 mark)

(ii) Power. (1 mark)

b) An object is placed at right angles to the principal axis of a thin diverging lens of focal length 40 cm. An image of height 15 cm is formed 20 cm from the lens. By construction, find the position and

height of the object. Find the magnification of the image. (6mks)

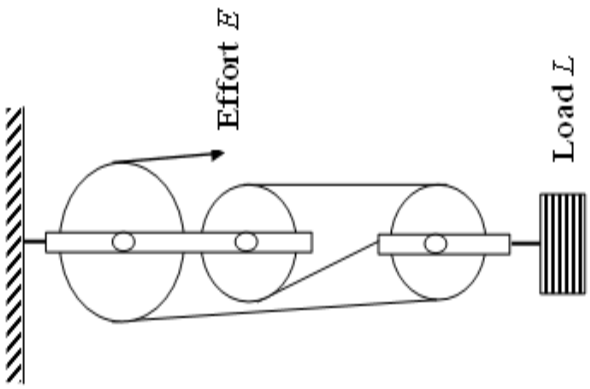
c) Use ray diagram construction to show how a thin converging lens can be used as a magnifying glass. (3marks)

d) Briefly describe an experiment to determine the focal length of a converging lens. (4marks)

e) State any two uses of a converging lens. (2marks)

7. a) Define efficiency of a machine. (1 mark)

b) The diagram above represents a pulley system in which an effort, *E* is applied to raise the load, *L*.



(i) Copy the diagram and indicate the forces acting in the string. (1mark)

(ii) What is the velocity ratio of the system?

(iii) Calculate the distance that the load moves when the effort moves through 2.4 m. (2marks)

(iv) What effort will just raise a load of 960 N, if the mechanical advantage is 2.4? (3marks)

(v) Use your results above to calculate the efficiency of the pulley system. (2marks)

c) (i) Draw a sketch diagram to show how the mechanical advantage of the pulley system in (b) varies with the load. (2marks)

(ii) Explain the features of the sketch in c) (i) (3marks)

d) Give two practical examples where pulley systems are used.

8. a) (i) Distinguish between **nuclear fusion** and **nuclear fission**. (ii)

State **one** example where nuclear fusion occurs naturally.

b) State **one** use of nuclear fission.

c) The following nuclear reaction takes place when a neutron bombards a sulphur atom.

$$^{34}_{16}S + ^{1}_{0}n \longrightarrow ^{a}_{b}Y$$

(i) Describe the composition of the nuclide, *Y*, formed. (2marks)

(ii) The nuclide *Y*, decays by emission of α-particles and γ-rays. Find the changes in mass number and atomic number of the nuclide.

(iii) State two properties of α-particles.

d) The half-life of the isotope cobalt-60 is five year. What fraction of the isotope remains after 15 years?

e) State

(i) **one** medical use of radioisotopes.

(ii) **two** ways of minimising the hazardous effects of radiation from radioactive materials.

END

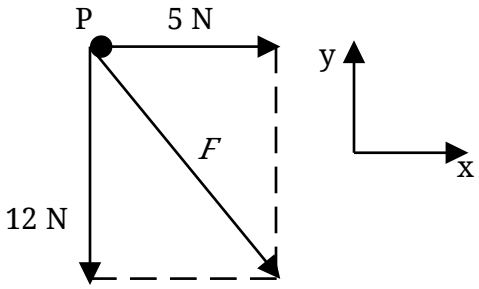
Solutions

1, a) Everybody continues in its state of rest or of uniform motion in

a straight line unless compelled by some external force to act otherwise.

The rate of change of momentum of a body is proportional to the applied force and takes place in the direction in which the force acts.

Whenever a force acts on one body, an equal and opposite force acts on some other body. OR; To every action, there is an equal and opposite reaction.



(i) F_y = -12 N; F_x = 20 – 15 = 5 N

$F = \sqrt{(F_x^2 + F_y^2)}$

$F = \sqrt{(5^2 + 12^2)} = \sqrt{169}$

F = 13 N

(ii) $F = ma$ i.e $a = \frac{F}{m}$

$a = -\frac{13}{2} = -6.5$ m s^{-2} This is deceleration.

Since the particle is coming to rest, $v = 0$. t = 5 s. u = ?

Use $v = u + at$ $\therefore 0 = u - 6.5 \times 5 \Rightarrow u = 32.5$ m s^{-1}

Use $s = ut + \frac{1}{2}at^2$

$s = 32.5 \times 5 - \frac{1}{2} \times 6.5 \times 5^2$

s = 81.25 m

c) (i) The trolley is decelerating because the distance between consecutive dots is reducing as the tape is pulled.

(ii) the time taken to make a dot space is $= \frac{1}{50} = 0.02$ s

Velocity $= \frac{dis\ tance}{time}$

$u = \frac{60}{0.02 \times 3} = 1000$ cm s^{-1} $= 10$ m s^{-1}

$v = \frac{15}{0.02 \times 6} = \frac{15}{0.12} = 125$ cm s^{-1} $= 1.25$ m s^{-1}

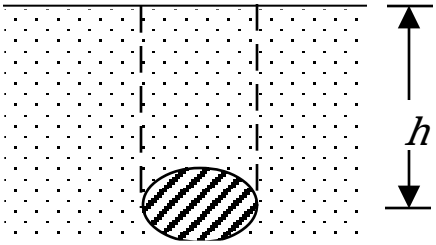
The time taken for velocity to change from u to v ,t = $0.02 \times 4.5 = 0.09$ s

$$a = \frac{v-u}{t} = \frac{1.25 - 10}{0.09}$$

$$a = \frac{-8.75}{0.09} = -97.2 \text{ m s}^{-2}$$

2. a) Pressure is the force acting normally per unit area.

b) Consider a cross-sectional area A below the surface of a liquid of density, ρ, at depth h.



Volume of liquid above A = Ah

Mass of liquid above A = $Ah\rho$

Weight of liquid above A = $Ah\rho g$

Pressure exerted on A = $\frac{Ah\rho g}{A}$ = $\rho g h$ A

c) (i) The pressure applied at any part of the surface of a completely enclosed fluid is transmitted equally throughout the whole of the fluid.

(ii) Load L = 4000×10 = 40000 N

Area of ram = 800 cm^2 = 800×10^{-4} m^2

Pressure exerted by load = $\frac{40000}{800 \times 10^{-4}}$ = 50×10^4 N m^{-2}

Pressure exerted by load = 5.0×10^5 N m^{-2}

Pressure exerted by pump piston = pressure exerted on L

Area of pump piston A = 2 cm^2 = 2×10^{-4} m^2

But force = area $\times$ pressure

$\therefore$ force exerted by pump = $5.0 \times 10^5 \times 2 \times 10^{-4}$ = 100 N

Since weight (force) w = mg; $\Rightarrow$ 100 = $m \times 10$

Hence m = 10 kg

d) (i)Atmospheric pressure is the pressure exerted by air in the atmosphere on any object on the earth's surface.

(ii) A small quantity of water is boiled in a metal can for a few minutes until the steam drives out all the air.

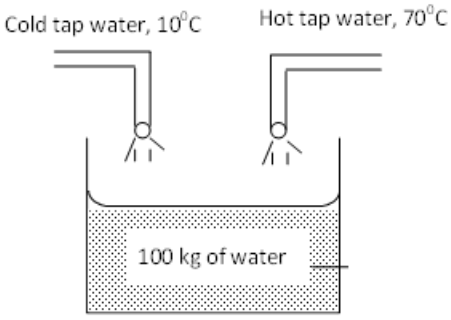
The can is fitted with an air-tight stopper and the flame beneath the can then turned out.

Cold water is poured on the can causing the steam inside to condense producing water and water vapour at very low pressure.

The excess atmospheric pressure outside the can causes it to collapse inwards.

3. a) Specific heat capacity of a substance if the quantity of heat required to raise the temperature of a unit mass of it through 1K.

b)



Let time taken for the temperature of the water to drop from 60^0C to 45^0C be t

Mass of cold water run into bath

$=20\ t$

Mass of hot water run into bath $=20\ t$

Total heat gained = $20\ t \times 4200 \times (45 - 10) = 2940000\ t$

Total heat lost = $20\ t \times 4200 \times (70 - 45) + 100 \times 4200 \times 15$

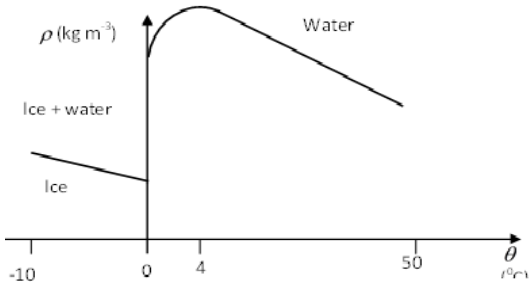
Total heat lost = $2100000\ t + 6300000$

From conservation of energy, heat gained = heat lost

$2940000\ t = 2100000\ t + 6300000 \Rightarrow t = \frac{6300}{8400} = 7.5$ min

c) (i) ρ = density and

θ = temperature



(ii) The anomalous behaviour of water helps in protecting/preserving aquatic life during winter. As temperatures fall, the density of water increases until it is maximum at 4^0C. The water at 4^0C therefore sinks into the sea. When temperature falls below 4^0C, density of water reduces and the light water stays on top until it freezes into ice at 0^0C,

which is lighter than water and floats. The ice, being a poor conductor of heat cannot conduct heat from the hotter water underneath to the outside. Therefore there is always unfrozen water under ice during winter for marine life to go on.

d) Because of its high specific heat capacity,

- water is used as a coolant in car radiators *to cool the engine*.
- water bodies like lakes stay with water during summer (or hot days) because evaporation is slow.

4. a) (i) ***Electrical power*** is the rate of transfer of electrical energy to other forms of energy per second/ unit time.

(ii) The ***kilowatt-hour*** is the electrical energy consumed/used at a rate of 1000 joules per second for one hour.

b) (i) P = 800 kW = 800,000 W; P.d = 11 kV = 11,000 V

use $P = VI$

$800{,}000 = 11{,}000 \times I \Rightarrow I = \frac{800{,}000}{11{,}000} = 72.7$ A

(ii) power loss, $P = I^2 R$

$P = 72.7^2 \times 10 = 52{,}853$ W i.e 52.853 kW

(iii) current I in the wires when transmitted at 415 V:

$I = \frac{P}{V} \Rightarrow I = \frac{800{,}000}{415} = 1.93$ A

$P = (1.93 \times 10^3) \times 10 = 37300$ kW

At 415 V, there is a very big power loss of 37300 kW in the cables as heat compared to 52.853 kW at 11,000 V

c) (i) A fuse is a safety device made of thin wire ,which melts when current through it exceeds the maximum safe value for which it is designed. When the fuse wire melts, the circuit in which it is connected is broken, thereby safeguarding the appliances and the

circuit cables against damage that would result from excess current.

(ii) The earth wire is used to remove excess leakage charges on the body/frame of electrical appliances and conducts them safely into the earth. It therefore always keeps the body of the electrical appliance at the earth potential, and it is thus always safe to touch.

d) Daily energy consumed by the lamp = 100×10 = 1 kWh

$\therefore$ weekly energy consumed by the lamp = 1×7 = 7 kWh

Weekly energy consumed by the electric fire = 2×10 = 20 kWh

Total energy consumed in one week = (7 + 200) kWh = 27 kWh

The cost of using the appliances in a week is 27×200 **= sh. 5,400/=**

e) Parallel circuit connections of appliances make each appliance to have the same p.d. i.e. the mains e.m.f. at which it operates optimally, while series connections make the mains p.d. or e.m.f to be distributed over all the appliances making each of the appliances to operate at a low p.d.

For parallel circuit connections, a fault in any circuit for one appliance does not affect other appliances, whereas in series circuit connections, a fault with one appliance affects all the rest.

5. a) Archimedes' principle states that *when a body is wholly or partially immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced*.

b) (i) A suitable solid which sinks in water is suspended from a spring balance in air and its weight W_1 noted.

A measuring cylinder is half filled with water and the volume V_1 of the water recorded.

With the solid still attached to the spring balance, it is gently

lowered into water until it is completely immersed.

The weight W_2 of the solid in water is noted as well as the new volume V_2 of the solid + water.

The volume V of the displaced water is calculated; $V = V_2 - V_1$

Weight of water displaced $= V\rho g$ is calculated where ρ is density of water and g is acceleration due to gravity.

Apparent loss in weight of solid $= W_1 - W_2$ is also calculated.

By comparison it is found that $W_1 - W_2 = V\rho g$

(Alternative method use a measuring cylinder and an overflow can)

(ii) weight W of solid block in air $= mg$

$W = 1 \times 10$ N

$\rho = \frac{m}{V}$, where ρ is density of block, m is mass and V is volume.

$9000 = \frac{1}{V} \Rightarrow V = 0.00011$ m^3

Mass of displaced water, $m_w = \rho_w \times V$

$m_w = 1000 \times 0.00011 = 0.11$ kg

Upthrust = weight of displaced water, $mg = 0.11 \times 10 = 1.1$ N

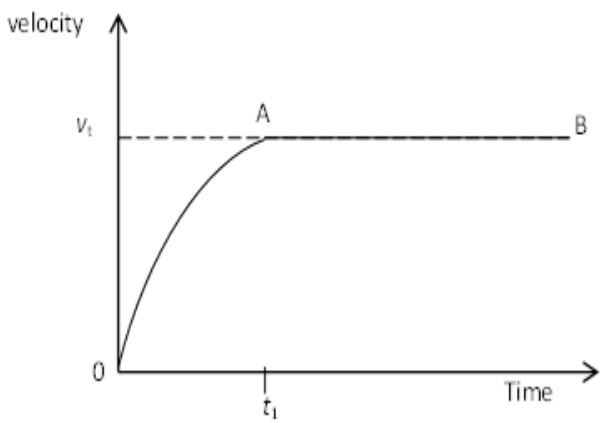
Tension in string T = weight in air - upthrust

$T = 10 - 1.1 = 8.9$ N

c) Plimsol lines on the side of cargo ships show the levels to which the water level should reach and this corresponds to the maximum safe cargo on board. Plimsoll lines are different for different water densities, for example, in summer, a ship carries greater load than in winter as a result of variations of the density of water.

Again sea water is denser than fresh water lakes implying bigger load for sea than for lakes.

d) (i)



(ii) From O to A, the ball accelerates with progressively

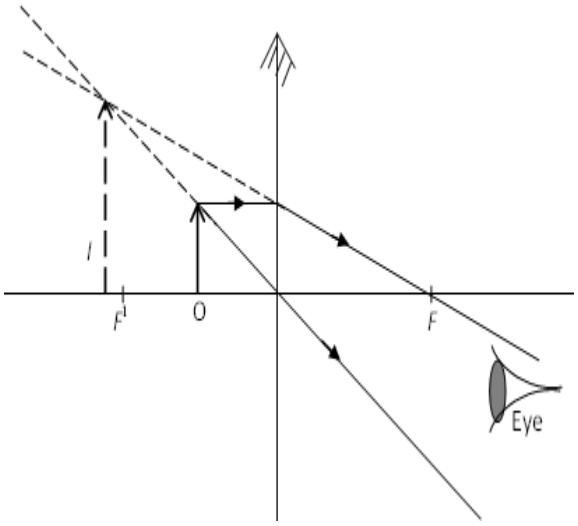
decreasing acceleration. Velocity increases to a maximum value v_t after time t_1.
At A, weight of ball equals the sum of upthrust and fore of viscosity resulting in zero accelerating force.
Between A and B the ball falls with constant velocity called terminal velocity.

6. a) (i) The principal focus of a convex lens is the point on the principal axis to which all rays originally parallel and close to the principal axis converge after passing through the lens.

(ii)The power of the convex lens is the reciprocal of its focal length in metres.

b) See GRAPH PAPER

c



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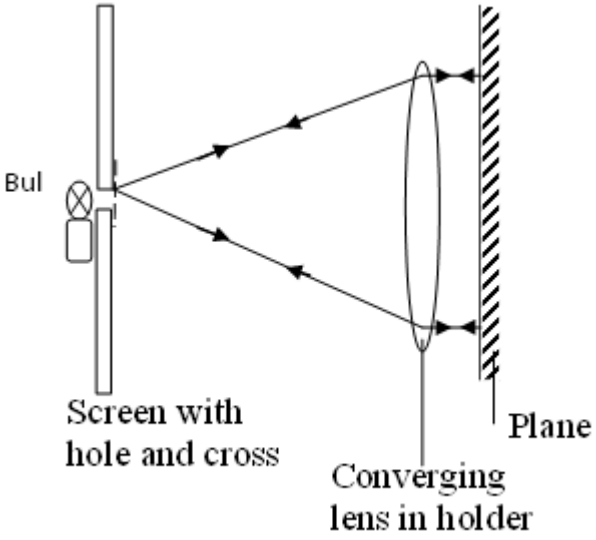


P

l

ace the convex lens in a holder and place the plane mirror behind it as shown.
Place a white screen with a small hole having a wire in front of the lens.
Illuminate the cross wires with a torch bulb and adjust the distance between the screen and the lens until a sharp image of the cross wires is formed on the screen besides the object.

Measure the distance between the lens and the screen and this is equal to the focal length of the lens.

Alternative methods:

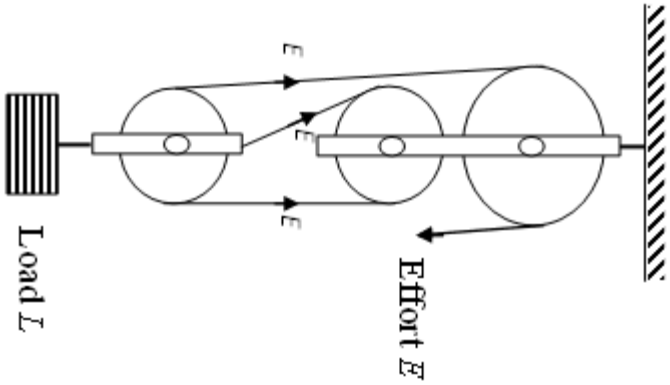
- use of lens formula and graph obtaining intercept;
- No parallax method using optical pin. Etc.

e) Converging lenses are used

- In lens cameras, to focus images on the screen.
- In projection lantern or projector, to focus images on the screen.
- In refracting telescopes, to magnify/ images of distant objects.
- In compound microscopes to magnify/ images of tiny near objects.
- As simple magnifying glasses, to magnify images of small objects without inverting them.
- In correction of long sightedness by focusing the images of near objects on the retina.

7. a) Efficiency is the ratio of the useful work done by the machine to the total work put into the machine.

b) (i)



(ii) Velocity ratio is **3**

(iii)Velocity ratio = distance moved by effort/distance moved by load in same time.

3 = $\frac{2.4}{d}$, where d is distance moved by load

d = $\frac{2.4}{3}$ = **0.8 m**

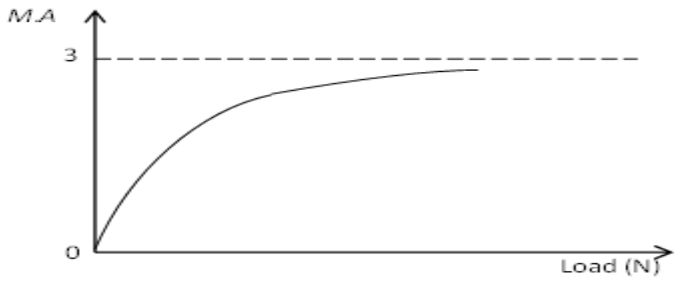
(iv) $M.A$ = $\frac{Load}{Effort}$

2.4 = $\frac{960}{E}$; E = $\frac{960}{2.4}$; Hence ***E*= 400 N**

(v) Efficiency, η = $\frac{M.A}{V.R} \times 100$

η = $\frac{2.4}{3} \times 100$ = **80%**

c) (i)



(ii) The graph starts from the origin (0,0) because when load is zero, there is some value of effort needed to raise lower pulley block + string and to overcome friction between movable parts.
As load increases, the proportion of useless work to useful work done decreases since weight of movable lower block is constant, implying that efficiency η increases. Since η increases, *M.A.* also increases according to

η = $\frac{M.A}{V.R} \times 100$, when *V.R.* is constant. **Therefore *M.A.* increases as load increases**.
However *M.A.* reaches a maximum constant value of 3 which it does not exceed.

d) Pulley systems are used
- In lifts to transport lift passengers and cargo in tall buildings.
- In cranes on breakdown tracks to carry damaged/broken vehicles.
- In cranes for loading /offloading ships at harbours.
- In conveyor belts for moving factory products, etc from

point to point.

- On rails to draw window, door or stage curtains.

8. a) (i) Nuclear fusion is a nuclear reaction in which two lighter nuclei combine under high temperature conditions to form a heavier nucleus while nuclear fission is a reaction in which a heavy nucleus splits to form lighter nuclei with a release of large amounts of energy.

(ii) Nuclear fusion occurs naturally in stars.

b) Nuclear fission is used in nuclear reactors which convert nuclear energy to electricity (nuclear power plants).

c) (i) $^{34}_{16}S + {}^{1}_{0}n \longrightarrow {}^{35}_{16}Y$

mass number of Y = 35, and atomic number = 16, i.e. it has got 16 protons and 19 neutrons.

(ii) $^{35}_{16}Y \longrightarrow {}^{31}_{14}X + {}^{4}_{2}He + \gamma$

The mass number reduces by 4 to 31, the atomic number decreases by 2 to 14.

(iii) α - particles

- cause intense ionisation of gas.
- Cause fluorescence of fluorescent materials.
- Are positively charged.
- Can be deflected by both electric and magnetic fields.
- Hardly penetrate matter.

d) Let initial mass be m_o

The mass present after 15 years is $\frac{m_o}{8}$ i.e. a fraction of $\frac{1}{8}\times$ mass at start.

mass	Time (years)
m_o	0
$\frac{m_o}{2}$	5
$\frac{m_o}{4}$	10
$\frac{m_o}{8}$	15

e) (i) Medical use:
- Treatment of tumours
- Sterilization of surgical equipment.

(ii) Ways of minimising hazardous effects of radiation from radioactive materials:
- Radioactive materials should be stored in thick lead boxes in thick concrete walled rooms.
- They should be handled using remote controlled forceps.
- Exposure should be limited to a certain recommended number.
- Radioactive material waste must be properly and safely disposed of so that it does not gain access into food chain; therefore it should be buried in deep pits.

SPECIMEN EXAMINATION 2

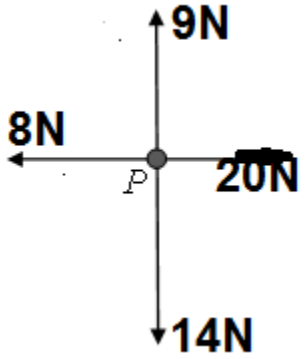
PHYSICS
PAPER 2
2 h 15 min

Answer only five questions.
These values of physical quantities may be useful to you.

Acceleration due to gravity, g	=	10 m s^{-2}
Velocity of electromagnetic waves in air	=	3×10^8 m s^{-1}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Density of water	=	1000 kg m^{-3}
Speed of sound in air	=	340 m s^{-1}

1. (a) Distinguish between vector and scalar quantities. (02mks)

(b) The figure above shows four forces acting on a particle *P* of mass 2 kg.



Determine

(i) the resultant force on *P* (03 marks)

(ii) the acceleration of *P* (02 marks)

(iii) the velocity of *P* after travelling a distance of 50 m from rest. (03 marks)

(c) (i) Describe an experiment to show the existence of surface tension. (04marks)

(ii) State two applications of adhesive forces. (02mks)

2. (a) (i) What is the difference between *specific heat capacity* and *heat capacity* of a substance? (02 marks)

(ii) Derive an expression relating the two quantities in (a) (i) above.

(b) Define absolute zero (01 mark)

(c) Using the kinetic theory of gases, explain the effect of temperature on pressure of a fixed mass of a gas at constant volume.

(d) A copper block of mass 250 g is heated to a temperature of 145 ºC and then dropped into a copper calorimeter of mass 250 g containing 250 cm^3 of water at 20 ºC.

(i) Calculate the maximum steady temperature attained by the water.

(i) State the assumption made in your calculations in (d)(i).

3. (a) (i) What are *paramagnetic materials*? (01 mark)

(ii) Give four examples of paramagnetic materials.(02mks)

(b) Describe briefly how one can test for the polarity of a magnet.

(c) (i) State the laws of *electromagnetic induction*? (02 marks)

(ii) Give four factors on which the e.m.f induced in a coil

depends.

(d) What is the difference between a generator and a transformer?

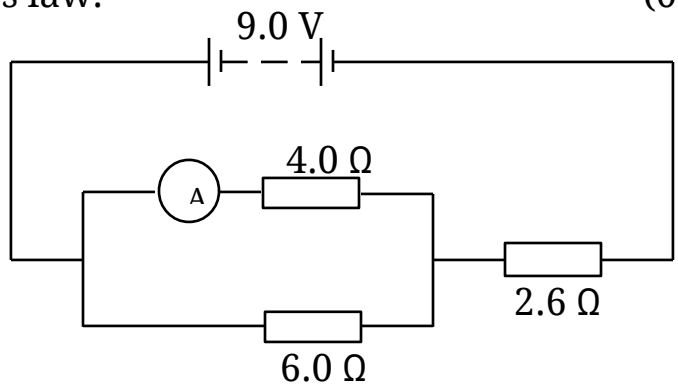
(e) (i) A transformer which is 80% efficient has an output of 12 Calculate the input current if the input voltage is 240 V.

(ii) State any two energy losses in a transformer and suggest how they can be minimised.

4. (a) Explain why a charged metal sphere connected to a pointed steel needle eventually loses charge. (04 marks)

(b) State Ohm's law. (01 mark)

(c)



The figure above shows a battery of e.m.f 9.0 V and negligible internal resistance connected to resistors 2.6 Ω, 4.0 Ω and 6.0 Ω. Determine

(i) the ammeter reading. (04 marks)

(ii) the power dissipated in the 2.6 Ω resistor. (02mks)

(d) The following appliances; two security flood lights each rated 1000 W, one flat iron rated 1500 W and two electric coils each rated 1800 W, are operated for 5 hours.

Find the cost of the total energy used by the appliances if each unit costs 650/= shillings. (03 marks)

5. (a) Define the following;

(i) Isotopes. (01 mark)

(ii) atomic number. (01 mark)

(b) The nuclide $^{220}_{84}X$ decays to a nuclide Y by emission of an alpha particle and three beta particles.

(i) Write a balanced equation for the decay process. (02mks)

(ii) What percentage of the original sample of the radioactive material is left after 3 half-lives? (04 marks)

(c) Give any four health hazards of radioactive radiations.

(d) (i) Draw a labelled diagram of a cathode ray oscilloscope. (03 marks)

(ii) Give the uses of each of the three main components of the cathode ray oscilloscope. (03 marks)

6. (a) Define the following terms;

(i) *Displacement* (01 mark)

(ii) *Uniform retardation* (01 mark)

(iii) A *watt* (01 mark)

(b) A body is projected vertically upwards.

Sketch the following graphs to represent the **upward motion**.

(i) Displacement – time graph. (02 marks)

(ii) Velocity – time graph. (02 marks)

(c) A bullet of mass 10 g is fired into a trolley of mass 400 g moving with a velocity of 4 m s^{-1} in the same direction on a smooth horizontal surface. After collision, the bullet and the trolley move together with a speed of 20 m s^{-1}.

Find the

(i) velocity of the bullet before collision. (03 marks)

(ii) percentage loss in kinetic energy (05 marks)

(d) State the two main forms of energy to which the lost energy in (c) above got transferred after collision (01 mark)

7. (a) State three differences between sound and light waves. (3mks

(b) (i) State three conditions necessary for the formation of a stationary wave. (03 marks)

(ii) Define the terms frequency and amplitude as applied to sound.

(c) A radio station broadcasts on 49 m band.

(i) What does the above statement mean? (01 mark)

(ii) Calculate the frequency of the broadcast signals.(03mks)

(d) A long open tube is partially immersed in water and a tuning fork is sounded and held just above it. If the tube is gradually raised and resonance first occurs when the length of air column is 0.2 m, find the frequency of the tuning fork. Neglect the end correction.

8. (a) Define

(i) Principal focus of a converging lens. (01 mark)

(ii) a virtual image. (01 mark)

(b) With the aid of a labelled diagram, describe the experiment to determine the focal length of a converging lens using a plane mirror.

(c) An object of height 4 cm is placed perpendicularly on the principal axis of a converging lens of focal length 15 cm, at a distance of 45 cm from the lens.

By ray diagram construction, determine

(i) the position of the image. (06 marks)

(ii) The magnification of the image. (02 marks)

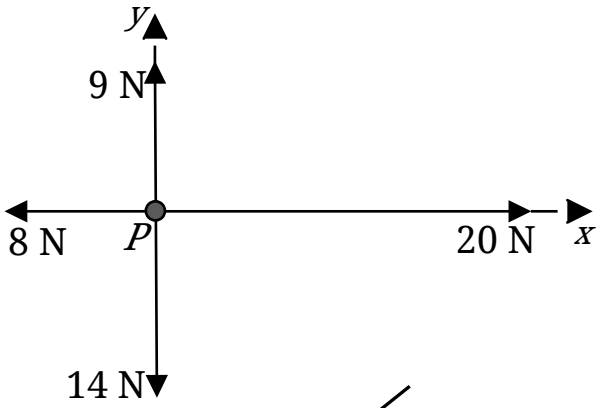
(d) State one application of converging lenses. (01 mark)

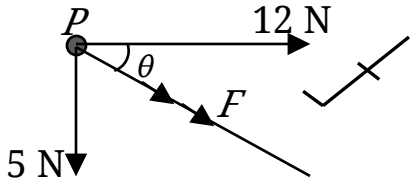
END

SOLUTIONS

1.(a) A *vector* quantity is the one which can be specified by magnitude and direction while a *scalar* quantity is the quantity that can be specified by magnitude only.

(b) (i)





$F_x = 20 - 8 = 12$ N, $F_y = 9 - 14 = -5$ N

$F = \sqrt{(5 + 12^2)} = \sqrt{169} = 13$ N

$\tan\theta = \frac{5}{12} = 0.4167 \Rightarrow \theta = \tan^{-1} 0.4167$

$\theta = 22.6°$

The resultant force is 13 N at 22 6º with the 20 N force to the south.

(ii) $F = ma$

$13 = 2.5 \times a \quad \therefore a = \frac{13}{2.5} = 5.2$ m s^{-2}

(iii) $s = 50$ m, $a = 5.2$ m s^{-2}, $u = 0$

Use $v^2 = u^2 + 2as$

$v^2 = 0 + 2 \times 5.2 \times 50 = 520$

$\therefore v = 22.8$ m s^{-1}

(c) (i)

- Pour water into a beaker, (trough or a dish) and allow it to settle.
- Place a steel needle on a dry filter paper or blotting paper and gently place the paper on the water surface.
- After some time, the blotting paper gets soaked and sinks leaving the steel needle on the surface of water.
- Surface tension forces support the needle and prevent it from sinking although it is denser than water.

Alternatively;

Place a rectangular (or circular) metal frame in a soap solution and remove it after it has trapped a thin film of soap solution.

Make a small loop of thread and carefully place it on the soap film held horizontally.

Pierce the film enclosed by the cotton loop.

After piercing the film, the loop is pulled outwards into a perfect circle by surface tension forces.

(ii)

- Paint gets stuck on walls because of adhesive forces between the paint and wall particles.
- Glue is used to stick objects together using the strong adhesive forces that hold the objects together.
- Cello tapes get stuck on surfaces of objects by adhesive forces.
- Vanish sticks on wood because of adhesive fo

ANY TWO

2. (a) (i) Specific heat capacity is the amount of heat required to raise the temperature of 1 kg mass of a substance by 1 K *while* heat capacity is the quantity of heat required to raise the temperature of a substance by 1 K.

2

(ii) Quantity of heat, $Q = mc\triangle\theta$; where m = mass, c = specific heat capacity, $\triangle\theta$ = temperature change

3

Again $Q = C\triangle\theta$; where C = heat capacity

$\therefore mc\triangle\theta = C\triangle\theta$

Hence $C = mc$

(b) Absolute zero is the temperature at which all matter in the universe is believed to have lost all its internal energy.

1

(c) When a gas is heated at constant volume, its temperature rises and the average speed of the molecules also increases. This results in increase of momentum of molecules. On collision with the walls of the container, momentum change per second increases, hence, increase in force per unit area i.e. pressure increases.

(d) m_s = 250 g = 0.250 kg, m_c = 250 g = 0.250 kg, θ_1 = 145 ºC, θ_2 = 20 ºC, specific heat capacity of copper = 400 J kg^{-1} K^{-1} final temperature, θ_3 = ?

Volume of water = 250 cm^3 $\therefore$ mass of water, m_w = volume ×density

m_w = 250 × 1 = 250 g or 0.250 kg

(i)

Heat lost by solid = Heat gained by + Heat gained by

$m_s c_s(\theta_1 - \theta_3) = m_w c_w(\theta_3 - \theta_2) + m_c c_c(\theta_3 - \theta_2)$

since $m_s = m_w = m_c$

$c_s(\theta_1 - \theta_3) = c_w(\theta_3 - \theta_2) + c_c(\theta_3 - \theta_2)$

$400(145^o - \theta_3) = 4200(\theta_3 - 20^o) + 400(\theta_3 - 20^o)$

$580 - 4\theta_3 = 42\theta_3 - 840 + 4\theta_3 - 80$

$580 + 840 + 80 = 42\theta_3 + 4\theta_3 + 4\theta_3$

$\frac{1500}{50} = \frac{50\theta_3}{50}$

θ_3 = 30 ºC

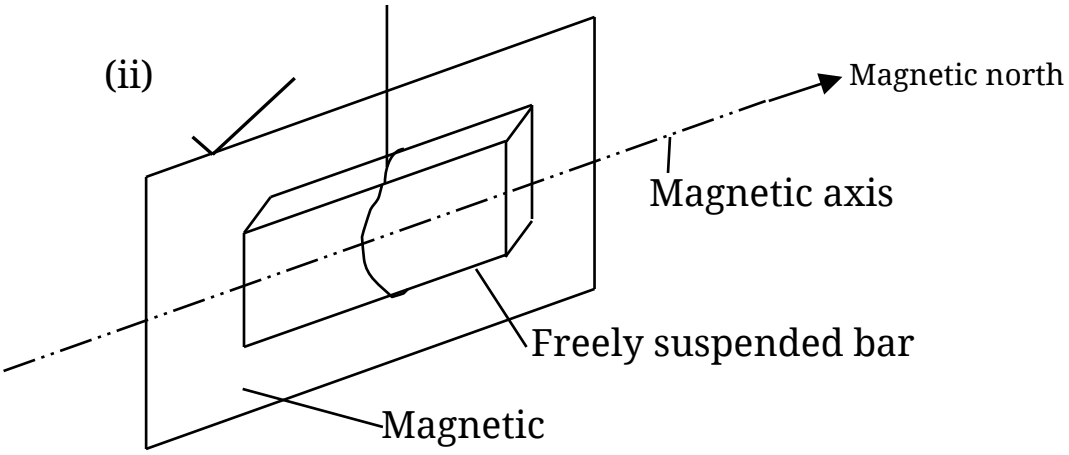
(ii) No heat is lost to the surrounding

3. (a) (i) Paramagnetic materials are those materials that are weakly attracted to magnets.

(ii) Examples of paramagnetic materials;

Aluminium, copper, uranium, platinum.

(ii)



A bar magnet is freely suspended about its centre of gravity using a cotton thread so that it is free to rotate. 3

After a short time the magnet comes to rest in an approximately N – S direction. The pole which points towards the north is the N – pole and the other one is the south pole.

The pole to be tested is *brought near any known pole* of the suspended magnet and if *repulsion occurs, it is the same as that of the suspended magnet*.

(c) (i)

- *Faraday's law*

Whenever there is a change in the flux linked with a circuit an electromotive force is induced, the strength of which is proportional to the rate of change of the flux linked with the circuit. 1

- *Lenz's law*

The direction of the induced current is always such as to oppose the change producing it. 1

(ii)

- Speed of rotation of the coil
- Area of the coil
- Number of turns of the coil

2

- Strength of the magnetic field.

(d) A generator is a device which converts mechanical/kinetic energy into electrical energy *while* a transformer is the device which can step up or step down alternating voltages. 2

(e) (i) Efficiency, η = 80%; power output, P_{out} = 12 W; voltage in primary, V_p = 240 V; current in primary coil, I_p = ?

$$\text{Efficiency} = \frac{\text{useful power output}}{\text{total power input}} \times 100$$

$$\eta = \frac{V_s I_s}{V_p I_p} \times 100$$

$$80 = \frac{12}{240 \times I_p} \times 100 \Rightarrow I_p = \frac{12 \times 100}{240 \times 80} = 0.0625 \text{ A}$$ 3

(ii)

- Energy loss as heat due to **eddy currents**; using laminated soft iron core.
- Energy loss as heat due to **hysteresis**; using soft iron core.
- Energy loss as heat against **resistance of coil windings**; using wires made of low resistance materials or using thick wires.
- Energy loss due to **flux leakage**; to design the core so that the coils are close together.

2

ANY TWO

4. (a) At the pointed end of a steel needle, there is a high surface charge density created.
This produces an intense electric field around the point.
Electrons produced by background radiation are accelerated by the field to the pointed end and ionize the surrounding air by collisions.
Positive ions are strongly repelled to form electric wind and negative ions are attracted and neutralise some of the charges at the pointed end and on the sphere. 4

As a result, the pointed end of the needle loses its charge rapidly to the surrounding air. Therefore charge leaks from the sphere via the pointed steel needle.

(b) Ohm's law states that the current passing through a wire at constant temperature is proportional to the potential difference between its ends. 1

(c) let R_1 4.0 Ω, R_2 = 6.0 Ω, R' = effective resistance of R_1 and R_2 in parallel

$$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R'} = \frac{1}{4} + \frac{1}{6} \Rightarrow R' = \left(\frac{4 \times 6}{4+6}\right) = 2.4\ \Omega$$ 1

Let effective resistance of the circuit be R.

R = 2.4 + 2.6 = 5.0 Ω

The current through the circuit, $I = \frac{V}{R}$ where V is emf of battery.

$I = \frac{9.0}{5.0}$ = 1.8 A

P.d. across parallel network, V' = IR'

V' = 1.8 ×2.4

V' = 4.32 V

Ammeter reading, $I_1 = \frac{V'}{R_1}$ 4

$I_1 = \frac{4.32}{4.0}$ = 1.08 A

(ii) Power dissipated in the 2.6 Ω resistor, $P = I^2R_3$ where R_3 = 2.6 Ω 2

$P = 1.8^2 \times 2.6$ = 8.424 W

(d) Energy consumed by;

Lamps = 2 × 1000×5×3600 = 36,000,000 J

Flat iron = 1×1500×5×3600 = 27,000,000 J

Electric coils = 2×1800×5×3600 = 64,800,000 J

Total energy = 36,000,000 + 27,000,000 + 64,800,000 = 127,800,000 J

Total number of units = $\frac{127,800,000}{3,600,000}$ = 35.5 (3)

Cost of electricity = 35.5×650 = sh. 23,075/=

(e) Primary cells are the cells in which the chemicals cannot be reconstituted into their original form once the energy has been exhausted *whereas* secondary cells are those which can be recharged. (2)

5. (a) (i) Isotopes are atoms of the same element which have the same atomic number but different mass number (1)

(ii) Atomic number is the number of protons in the nucleus of atom. (1)

(b) (i) $^{220}_{84}X \longrightarrow {}^{216}_{85}Y + {}^{4}_{2}He + 3\,{}^{0}_{-1}e$ (2)

(ii)

t	m(g)
0	220
T	110
$2T$	55
$3T$	27.5

(2)

m is mass present

T is half life period

t is time

After 3 T i.e. 3 half lives, mass remaining is 27.5 g

Remaining percentage = $\frac{27.5}{220}\times 100$ = 12.5% (2)

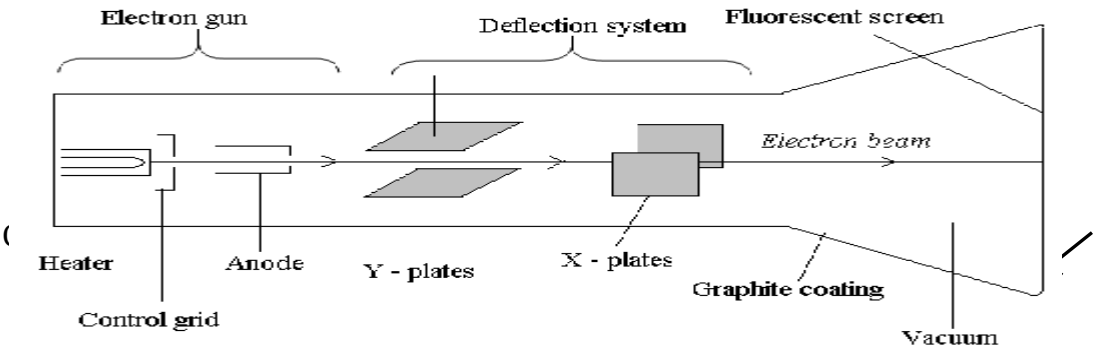
(c) Radioactive radiations cause

- Radiation burns (2)

- Leukaemia (blood cancer)
- Sterility
- Mutation
- Low body resistance to normal diseases as a result of damage to blood corpuscles

ANY 1ST FOUR

(d) (i)



(ii)

- **Electron gun**: thermionic production of electrons, acceleration and focusing of cathode rays onto the screen.
- **Deflection system**: deflects the electron beam vertically and horizontally.
- **Fluorescent screen**: fluoresces and displays signals in parts struck by cathode ray beam.

3

6. (a) (i) Displacement is the distance moved in a specific direction.

1

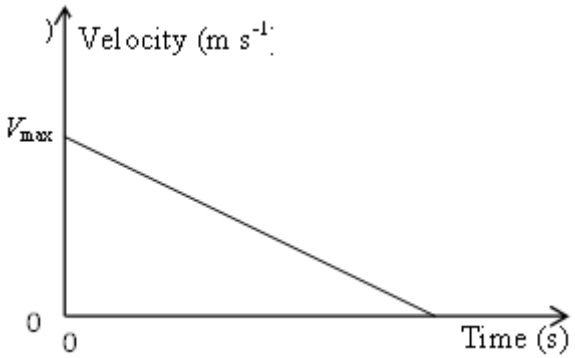
(ii) Uniform retardation is the constant rate of decrease of velocity with time.

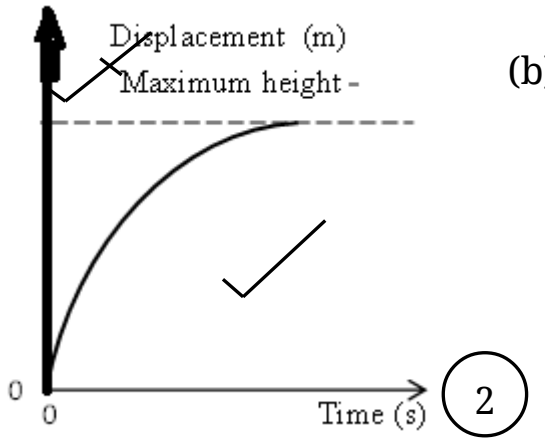
1

(iii) A watt is the rate of transfer of energy of one joule per second.

1

(b) (i)





2

(c) (i)

Momentum before collision = Momentum after collision

2

$m_b u_b + m_t u_t = (m_b + m_t) v$

$m_b u_b = (m_b + m_t) v$

m_b = 10 g = 0.01 kg, m_t = 400 g = 0.400 kg, u_t = 4 m s^{-1}, v = 20 m s^{-1}

$u_b \times 0.01 + 0.400 \times 4 = (0.01 + 0.400) \times 20$

3

$u_b = \left(\frac{8.2 - 1.6}{0.01}\right) =$ 660 m s^{-1}

(ii) kinetic energy before collision, k.e.

k.e. = $\frac{1}{2} m_b u_b^2$

k.e. = $\frac{1}{2} \times 0.01 \times 660^2 =$ 2178 J

k.e. after collision = $\frac{1}{2}(m_b + m_t) v^2$

k.e. = $\frac{1}{2}(0.01 + 0.400) \times 20^2 =$ 82 J

loss in k.e. = k.e. before collision – k.e. after collision

loss in k.e. = 2178 – 82

loss in k.e. = 2096 J

5

$$\% \text{ loss in k.e.} = \frac{\text{loss in k.e}}{\text{k.e.before collision}} \times 100$$

$$\% \text{ loss in k.e.} = \frac{2096}{2178} \times 100 = 96.2\%$$

(d) Sound energy, internal energy. 1

7. (a)

- Sound waves are longitudinal while light waves are transverse.
- Sound waves cannot travel through vacuum while light waves can travel in vacuum
- The speed of sound in air is low, i.e. 330 m s^{-1} while the speed of light in air is very high, i.e. 3×10^8 m s^{-1}.

(b) (i)

- Two wave travelling in **opposite directions in same medium** interact are superimposed on one another.
- The two waves must have the **same frequency** and **same amplitude**.

(ii)

Frequency refers to the number of complete oscillations per second. Amplitude of a wave is the maximum displacement of a particle from the rest position.

(c) (i) λ = 49 m. This means that the wavelength of the radio signals broadcast from the station is 49 m.

(ii) λ = 49 m, $v = 3 \times 10^8$ m s^{-1}.

Use $v = f\lambda$

$3 \times 10^8 = f \times 49$

$f = \frac{3 \times 10^8}{49} = 6122449$ Hz i.e. $f \approx 6.1$ MHz

(d) $l_1 = 0.2$ m, $v = 340$ m s^{-1},

For first position of resonance, $l_1 + c = \frac{\lambda}{4}$ If end correction is neglected, $c = 0$

$l_1 = \frac{\lambda}{4} \therefore 0.2 = \frac{\lambda}{4} \Rightarrow \lambda = 0.2 \times 4 = 0.8$ m

but $v = f\lambda$, $\therefore 340 = 0.8 \times f$ Hence $f = \frac{340}{0.8} = 425$ Hz

8.(a) (i) The principal focus of a converging lens is the point on the principal axis to which all rays originally parallel and close to the principal axis converge after passing through the lens.

(ii) A virtual image is the image formed by apparent intersection of ray when their directions have been produced backwards.

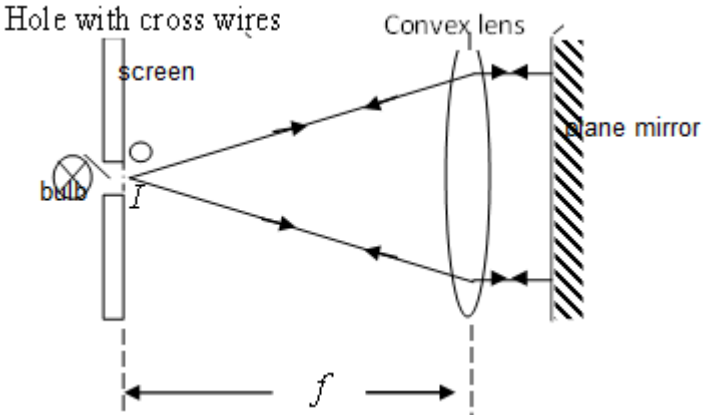
(b) The lens is set up vertically in a lens holder with a plane mirror behind it.

An illuminated object consisting of a hole and a wire gauze in a screen is arranged so that it is on the principal axis of the lens.

The screen iv moved to and fro along the axis until a clear sharp image is formed on the screen besides the object.

The distance between the screen and the lens is measured and recorded.

It is equal to the focal length, f of the lens.



(c) SEE GRAPH PAPER

(d) Applications of converging lenses:

- Applied in magnifying glasses to magnify tiny near objects.
- Applied in lens camera to form image of object on the screen.
- They are applied in eye glasses to correct long-sightedness.
- They are applied in projectors to project images on the screen from objects on the slides.
- Etc

ANY ONE

PHYSICS 5352

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

- Attempt five questions
- Where necessary
  - Acceleration due to gravity g = $10ms^{-2}$
  - Specific heat capacity of water = $4200Jkg^{-1}$
  - Specific latent heat of vaporization of water = 2.26 x $10^{6}Jkg^{-1}$.

Student Examination Set A

1. (a) (i) Define **pressure**.
   (ii) Explain briefly why a needle enters deeper into the human fresh than a nail even when the same force is applied on each

   (b) (i) With the aid of a labeled diagram describe the action of a force pump.

   (ii) In a force pump, a force of 50N is applied on a piston of diameter 0.4m during the down stroke. Find the pressure exerted on the water by the piston.

   (c) (i) Define **moment of a force**.

   (ii) State two ways of increasing the stability of an object.

   (d) (i) A uniform metre rule of mass 80g is pivoted at the 30cm mark. Find the mass that would be placed at the 5cm mark for the metre rule to be in equilibrium.

2. (a) what is meant by:

   (i) Velocity ratio of a machine?

   (ii) **Pitch of a screw**?

   (b) A screw jack with a lever arm of 40cm and a pitch 2.0cm is used to raise a heavy load

   (i) Find the velocity ratio of the screw jack

   (ii) State two practical applications of block and tackle pulley system

(c) (i) State the **principle of conservation of linear momentum**.
(ii) A dog of mass 8kg chases A bicycle rider at A speed of $20ms^{-1}$. The mass of the rider and the bicycle is 48kg and in moving at a speed of $5ms^{-1}$. If the dog rams and sticks into the spokes of the bicycle, find their common velocity after, and the type of the collision.

(d) An inflated balloon is brown full of air and its neck tied with a thread. Explain briefly what happens when the balloon is simultaneously untied and released.

(e) (i) State **Archimedes' principle**.
(ii) A swimmer of weight 600N dives into water in a swimming pool and displaces 200N of water. Find the weight of the swimmer when fully under water

3. (a) (i) Define **specific latent heat of vaporization f a liquid**.

(ii) Briefly explain the process of cooling of a liquid by evaporation

(b) Calculate the heat require to completely evaporate 2kg of water initially at $28^{o}C$ assuming it boils at $100^{o}C$

(c) Draw a well labeled diagram of a vacuum flask and briefly explain how it minimizes heat loss from a hot liquid kept into it.

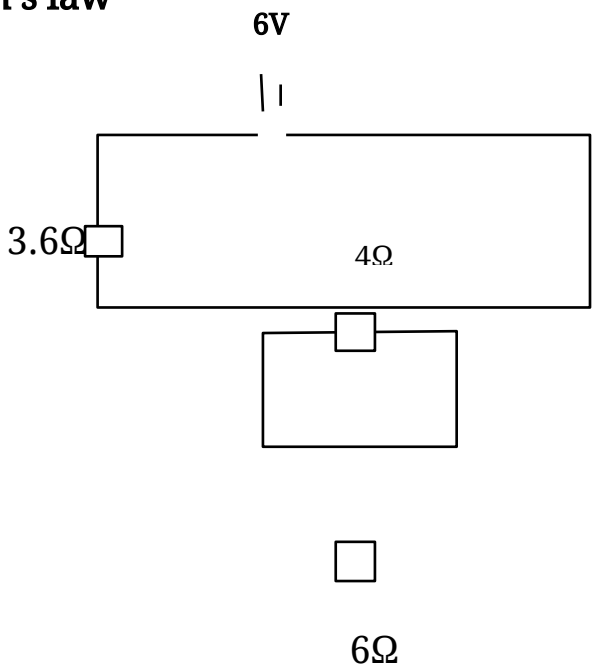
(d) Explain why tea cups are usually made of clay materials and not metals.

4. (a) Explain what happens when two insulators of different materials are rubbed together

(b) Describe how a lightening conductor safe guards a building from lightening

(c) State **Ohm's law**

(d)



A battery of e.m.f 6Vand negligible interval resistance is connected to 3.6Ω, 4Ω and 6Ω resistors as a shown in figure 1 above. Find the:

(iii) Total current flowing through the circuit.

(iv) Power dissipated in the 3.6Ω resistor

(e) Sketch the I – V characteristics for the filament of a lamp.

5. (a) (i) State **Faraday's law of electromagnetic induction.**

(ii) With aid of a well labeled diagram, describe the mode of operation of a direct current generator.

(v) State two ways of increasing the e. m. f produced by the generator.

(b) What is the country wide commonly used type of transformers?

(c) A 250V mains transformer of 2000 turns in the primary winding is used to operate a 200W, 80V electric motor. Find the

(i) Current flowing through the motor
(ii) Number of turns in the secondary winding

(d) (i) What is **a kilowatt hour**?

(ii) Find the cost of using four 200W bulbs of 10 hours if one unit of electricity costs sh.540

6. (a) Define the following terms as applied to concave mirrors

(i) **Principal focus**

(ii) **Aperture**

(b) (i) With aid of a ray diagram, explain why a parabolic mirror is preferred to A concave mirror for use in torches

(ii) An object is placed 20cm in front of a concave mirror of radius of curvature 30cm. Find the distance of the image from mirror.

(c) (i) What is **a pure spectrum**?

(ii) Use a ray diagram to show a glass prism forms a spectrum of white light.

(d) Explain how short sightedness defect of the eye can be corrected.

7. (a) (i) What is sound?

(ii) Describe an experiment of determine the velocity of sound in air using a resonance tube

(b) A girl standing 300m away from a high vertical wall makes a loud sound of frequency 60Hz. If she takes 1.8 seconds to hear her echo, calculate the

(iii) Speed of wound in air

(iv) Wavelength of the sound waves

(c) Distinguish between **transverse** and **longitudinal waves**, giving one example of each.

(d) With aid of a diagram show how plane weaves are diffracted after passing through a

(iii) Narrow opening

(iv) Wider opening

8. (a) (i) What are **cathode rays**?

(ii) With aid of a labeled diagram describe the mode of operation of a cathode ray tube

(v) State one practical application of cathode ray tubes

(b) (i) What are **alpha particles**?

(ii) An element C_{29}^{60} decays by emission of one alpha particle and one beta particle to an element X. Write a well balanced equation of the decay.

\\

(ii) The half life of radioactive substance is 4 days. If the original mass of the substance is 8g, find the mass left after 20 days.

(d) State two uses of radio isotopes

END

PHYSICS

PAPER 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Answer only five questions.
- These values of physical quantities may be useful to you.
- Acceleration due to gravity = 10 m s^{-2}
- Density of mercy = 13,600 kg m^{-3}
- Specific heat capacity of copper = 400 J kg^{-1} k^{-1}

1. (a) State any two Newton's laws of motion.
(2 mks)

(b) A car accelerates uniformly from rest for 30 seconds with an acceleration

of 2 m s^{-2}. It then travels at a constant speed for 1.5 minutes before being decelerated uniformly to rest in a further 10 seconds.

(i) Find the maximum speed of the car.(2 mks)

(ii) Sketch a velocity-time graph of the motion.(2 mks)

(iii) Use the graph to find the total distance travelled.

(c) Two similar trucks, one empty and another carrying a heavy load, are moving at the same speed along a highway. On seeing the traffic lights turning red from a distance, both drivers apply brakes with the same amount of braking force.

(i)Explain why the truck with a heavy load would need a longer distance to stop than the empty one. (3 mks)

(ii) State the energy changes that take place in a truck when the brakes are applied. (2 mks)

(d) A bullet of mass 6 x 10^{-3} kg travelling at 120 m s^{-1} penetrates deep into the fixed target and is brought to rest in 0.01 seconds.

Find the force exerted on the bullet. (3 mks)

2 (a) (i) Explain using a suitable example,the term friction.(2mks)

(ii) State <u>one</u> advantage and one disadvantage of friction(2 mks)

(iii) How does lubrication reduce friction? (1 mk)(b) (i) State Archimedes' principle. (1 mk)

(ii) A block of volume 4 x 10^{-4} m^3 weighs 30 N in a liquid of density, 1,200 kg m^{-3}. Calculate the weight of the block in air.(3mks)

(c) State the factors that affect pressure in liquids.(3 mks)

(d) The height of the mercury in a barometer on a boat on the surface of lake Victoria is 75cm.

Calculate the total pressure in N m^{-2} acting on a fish 1.2 m below the surface of water if the density of water is

1,200 kg m^{-3}.(4 mks)

3 (a) Given an illuminated object and a screen, describe an accurate method to determine the focal length of a thin converging lens.(6 mks)

(b) An object, 2.5 cm high, is placed at a distance of 15.0 cm from a converging lens of focal length 10.0 cm.

(i) Find the power of the lens. (2 mks)

(ii) Find, by graphical method, the position and size of the image formed.(5 mks)

(c) (i) Distinguish between a primary colour and a secondary colour. (2 mks)

(ii) Fig 1 shows a ray of white light incident on a yellow light filter followed by a green filter.

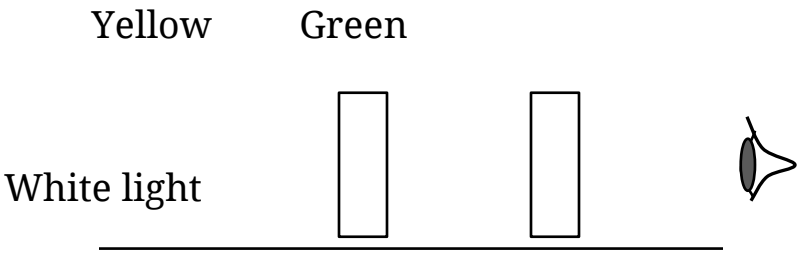


Fig.1

What colour does the eye see? (1 mk)

4. (a) With the aid of a labelled diagram, describe an experiment to verify the pressure law applied to gases. 6 mks)

(b) Dry air is enclosed in a metallic container with a cork seal. The container is heated to a very high temperature.

Explain why the cork jumps off. (3 mks)

(c) Define specific heat capacity. (1 mk)

(d) In an experiment to determine the specific heat capacity of a liquid, 0.2 kg of the liquid is placed in a well lagged copper colorimeter of mass 5 x 10^{-2} kg.A 20 W immersion heater is used to heat the liquid and the temperature rises from 25 ^{o}C to 35 ^{o}C in 5 minutes.

Calculate;

(i) the quantity of heat supplied by the heater.(2 mks)

(ii) the specific heat capacity of the liquid. (4 mks)

5 (a) (i) What is internal resistance of a cell?. (1 mk)

(b) The circuit in fig. 2 shows a battery of e.m.f 18 V and negligible internal resistance connected to a system of resistors

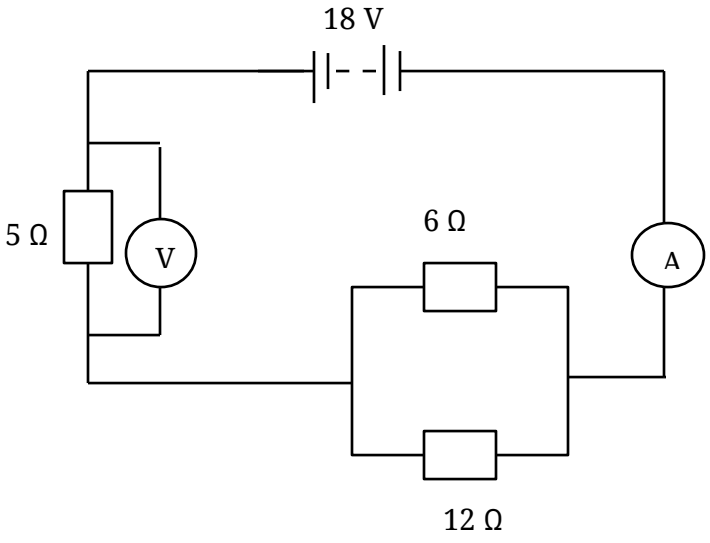


Fig 2.

Find the (i) ammeter reading (5 mks)

(ii) voltmeter reading (2 mks)

(c) A textile industry uses a d.c. motor rated 240 V, 2.5 kW for 8 hours. How much does the industry pay o the electricity company if one unit costs shs 650/=. (3 mks)

(d) In electrical wiring of a house, fuses are usually included in the circuits as a safety measure. Give <u>two</u> possible faults that may lead to the fuse melting or blowing.(2 mks)

6 (a) (i) Distinguish between a longitudinal wave and a transverse wave. (2 mks)

(ii) Give one difference between light waves and sound waves.(1mk)

(b) The diagram in fig. 3 shows circular wave fronts propagating towards a plane reflector.

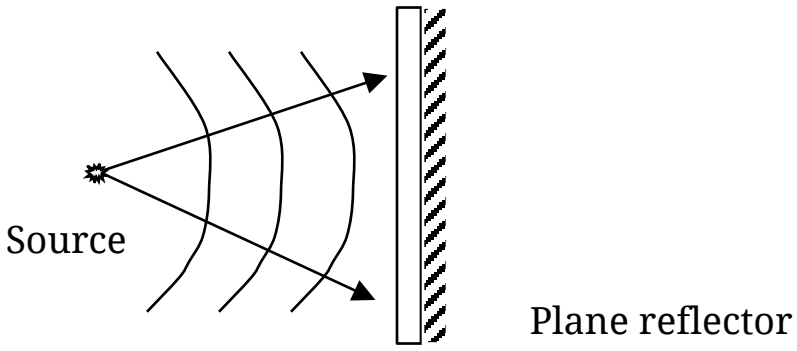


Fig 3

Draw a diagram to show the reflected waves. (2 mks)

(c) Describe an experiment to show that sound cannot travel through a vacuum. (5 mks)

(d) A radio station broadcasts at a frequency of 200 MHz. Calculate

the velocity of the radio waves if their wavelength is 1.5 m.(3 mks)

(e) Explain why it is difficult to hear clearly someone speaking across a large hall packed with metallic chairs. (3 mks)

7 (a) (i) Draw the magnetic field between two north poles near each other. (3 mks)

(ii) Distinguish between a soft magnetic material and a hard magnetic material. (2 mks)

(b) (i) With the aid of a labeled diagram, describe how an a.c. transformer works.(6 mks)

(ii) State the causes of power loss in a transformer.(2 mks)

(c) An a.c. transformer is connected to a 240 V mains supply to supply a current of 0.6 A to a load connected to its secondary. If a p.d. of 120 V is supplied to the load when the transformer is 80% efficient, find the current in the primary. (3 mks)

8 (a) Define the following;

(i) mass number (1 mk)

(ii) isotopes (1 mk)

(b) Define half-life. (1 mk)

(c) If the mass of $^{234}_{91}Pa$ takes 20.8 hours to reduce from 80 g to 5 g, determine the;

(i) half life of the nuclide (3 mks)

(ii) decrease in mass after 26 hours. (3 mks)

(d) State <u>two</u> industrial uses of radioisotopes.(2 mks)

(e)i) Explain the principle of operation of a diode.(2)

(ii) Briefly explain thermionic emission and how its achieved in a diode.(2)

END

SAMPLE SPECIMEN PAPER 1

535/1 PHYSICS

PAPER 1

TIME: 2 HOURS 15 MINUTES

Instructions to candidates

Write your name, centre/Index number and signature in the space above

Section A contains 40 objective type questions. You are required to write the correct answer A,B,C or D in the boxes at the right hand side

Section B contains 10 structured questions. Answers are to be written in the spaces provided on the question paper.

Acceleration due to gravity = 10 m s^{-2}

Specific heat capacity of water = 4200 J kg^{-1} K^{-1}

Speed of sound in air = 330 m s^{-1}

For Examiners use only

Qn4	Qn4	Qn4	Qn4	Qn4	Qn4	Qn4	Qn4	Qn4	Qn5	MC	Tot

1	2	3	4	5	6	7	8	9	0	Q	al

SECTION A

1. A wave has a period of 0.025 s and a wavelength of 2 m. Calculate its speed

A. 1.3×10^{-2} m s^{-1}

B. 5.0×10^{-2} m s^{-1}

C. 8.0×10^{1} m s^{-1}

D. 2.0×10^{2} m s^{-1}

C

2. A plastic ruler rubbed through hair is brought near small pieces of paper. The force between the ruler and paper is

A. magnetic Iron

B. elastic

C. frictional

D. electrostatic

D

3. Walking to the top of a steep hill usually seems to be easier if a

zig-zag path is used instead of climbing by the steepest route. This is because

A. less energy is used

B. less friction has to be overcome

C. less power is needed

D. less time is wasted

C

4.

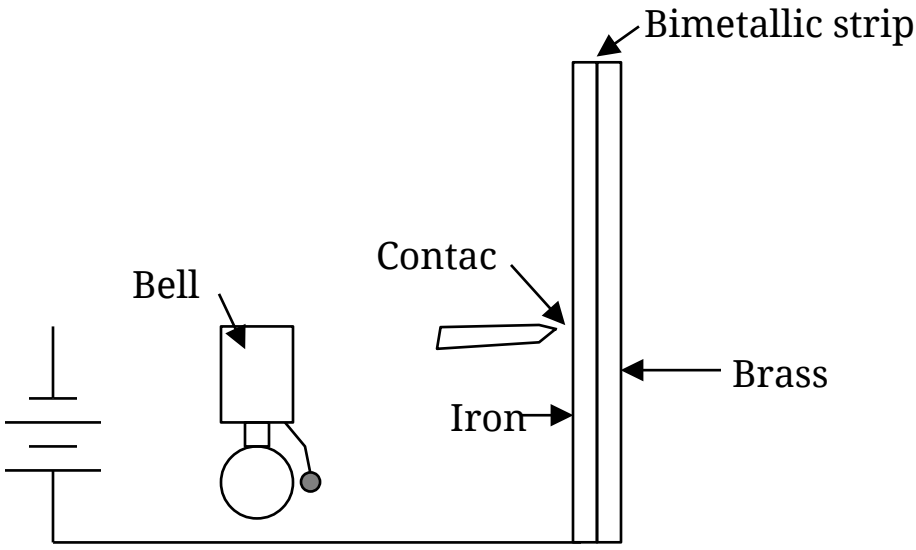


Fig 5

Fig 5 shows a design for a simple fire alarm. The bell rings when the temperature reaches a certain level because, on heating

A. brass expands less than iron.

B. brass expands more than iron.

C. sparks are able to jump the gap.

D. the contact becomes magnetic.

B

5. When the pitch of a note is raised, which property of the note is

increased?

A. Frequency

B. Wavelength

C. Amplitude

D. Speed

A

6. Which of the following is not a property of magnetic field lines?

A. They start from North Pole to South Pole.

B. They don't cross each other.

C. They start from South Pole to North Pole.

D. They attract each other if they are of opposite poles.

C

7. Which of the following describes the image formed in a pinhole camera by a distant upright object?

A. Upright, real and magnified.

B. Upright, real and diminished.

C. Upright, virtual and diminished.

D. Inverted, real and diminished.

D

8. A plastic material is placed between the wall and the foundation during construction in order to

A. reduce adhesive forces

B. minimize capillary attraction of moisture from ground

C. give a firm grip between the wall and foundation

D. increase cohesive forces.

B

9. A body starts with initial velocity u and moves with acceleration a to cover a distance x in time t.
Find the value of a in terms of u, x, and t.

A. $\frac{2x-ut}{t^2}$

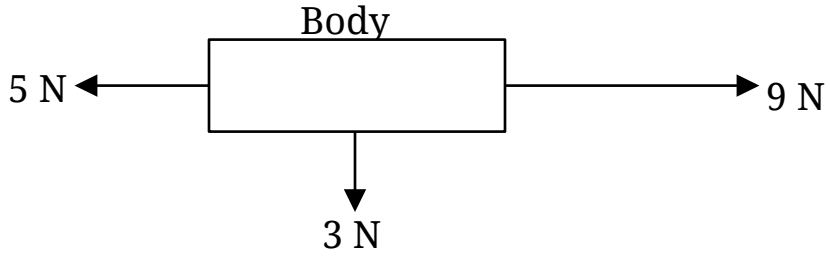
B. $\frac{2(x-ut)}{t^2}$

C. $\frac{2(x+ut)}{t^2}$

D. $\frac{2t}{t^2} - u$

B

10.



Three forces of 3 N, 5 N and 9 N act on a body as shown above. Find their resultant on the body.

A. 5.0 N

B. 5.8 N

A

C. 10.7 N
D. 17.0 N

11. A car of mass 1000 kg is retarded uniformly with a retarding force of 5000 N from a velocity of 20 m s^{-1} to rest.
Calculate the time taken.

C

A. 0.25 s
B. 2.00 s
C. 4.00 s
D. 100.00 s

12. What energy changes take place in an electric generator?
A. Chemical → kinetic → sound → electrical
B. Chemical → heat → kinetic → electrical
C. Chemical → kinetic → electrical
D. Kinetic sound electrical

B

13. which one of the following apparatus is most sensitive in the measurement of length?
A. Metre rule
B. Engineer's calipers
C. Vernier calipers
D. Micrometer screw gauge

D

14. A rectangular block of metal weighs 5 N and measures 2 cm × 3 cm × 4 cm.
What is the least pressure which it can exert on a horizontal surface?
A. 2.10×10^{-7} Pa
B. 4.17×10^{-5} Pa 4.17×10^{3} Pa

C. 6.25×10^{-5} Pa

D. 8.30×10^{-5} Pa

15. Water wets glass because its

A. density is low

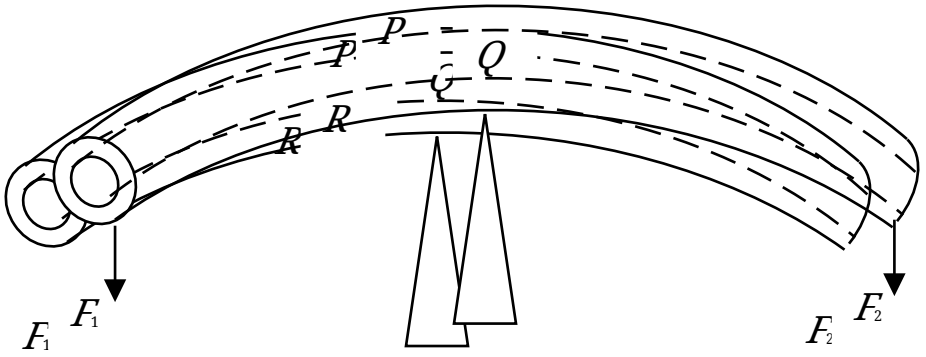
B. surface tension makes it spread out

C. molecules are elastic

D. adhesive force with glass is greater than its cohesive force.

D

16.



The beam shown above is being acted upon by forces F_1 and F_2 as shown. The regions P, Q and R are respectively,

A. tension, compression, neutral axis

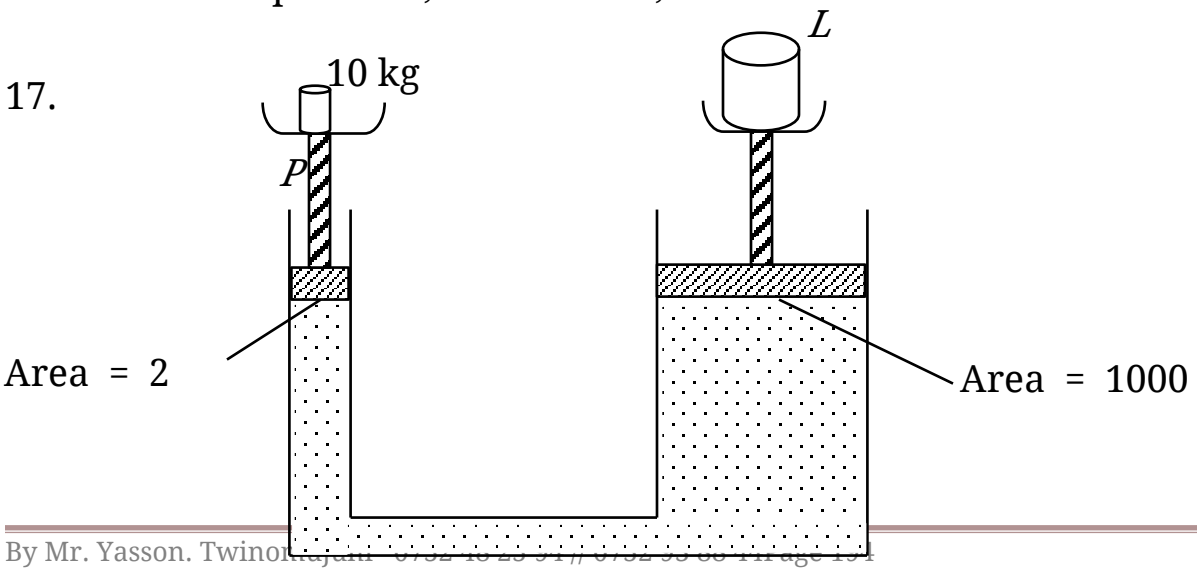
B. neutral axis, compression, tension

C. tension, neutral axis, compression

D. compression, neutral axis, tension

C

17.



Calculate the load *L* which can be used when a mass of 10 kg is placed on the pump piston *P* in the machine as shown above.

A. 50 N
B. 100 N
C. 5,000 N
D. 50,000 N

D

18. Sound of wavelength 6.6 m is produced by a vibrating source. If the velocity of sound in air is 330 m s-1, find the frequency of the source.

A. 0.02 Hz
B. 50.00 Hz
C. 336.60 Hz
D. 2178.00 Hz

B

19. Which one of the following is obtained at resonance in forced oscillations?

A. Maximum amplitude
B. Maximum frequency
C. Maximum velocity
D. Maximum period.

A

20. Which of the following information is true about concave and convex lenses?

	Concave lens	Convex lens

A. Refracts light — Diffracts light
B . Converges light — Diverges light
C . Diverges light — Converges light
D . Deviates light — Reflects light

C

21. When a rod is brought close to the brass cap of a positively charged gold leaf electroscope and the leaf diverges, it shows that the rod is

A. negatively charged
B. positively charged
C. neutral
D. partially charged

B

22. Which of the following is a list of fundamental units only?

A. kilogram, second, metre
B. kilogram, second, joule
C. newton, metre, Kelvin
D. newton, second, metre

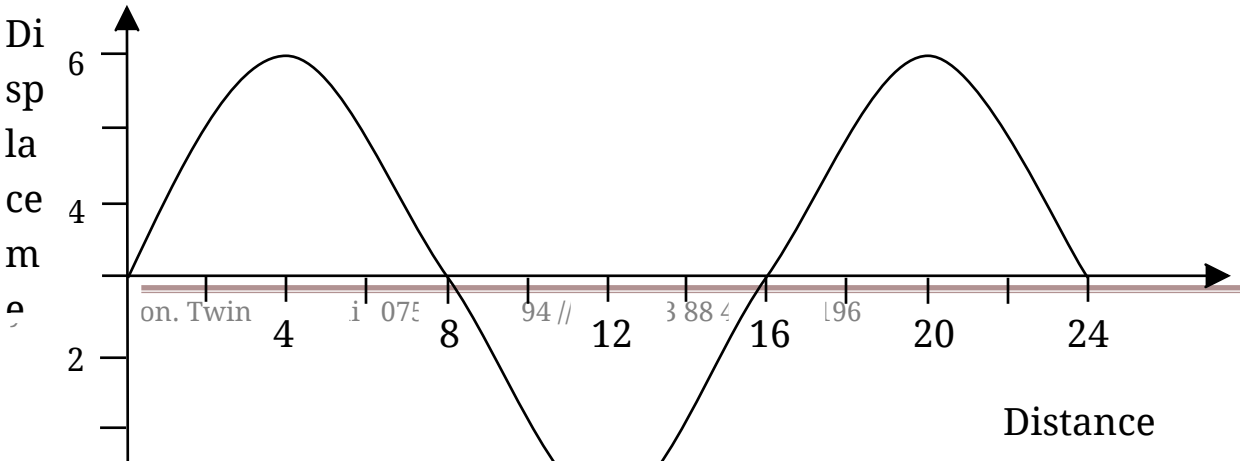
A

23. The order of events in the four- stroke cycle of a petro engine is

A. induction, compression, power, exhaust
B. induction, power, compression, exhaust
C. compression, induction, exhaust, power
D. Compression, induction, power, exhaust

A

23.



The wavelength of the wave shown above is

A. 6 cm

B. 8 cm

C. 16 cm

D. 24 cm

C

24. Two solid cubes have the same mass but their surface areas are in the ratio of 1 : 16 What is the ratio of their densities?

A. 1 : 2

B. 4 : 1

C. 64 : 1

D. 1 : 64

C

25. At room temperature, water is denser than air because water molecules

A. move slower

B. move faster

C. have greater forces of attraction

D

D. are more closely packed

26. Which one of the following sets contains scalar quantities only?

A. weight, displacement, acceleration, magnetic field

B. energy, electric field, momentum, distance

C. mass, velocity, force, speed

D. specific heat capacity, power, time, volume

D

27. Which of the following factors affects the velocity of sound in air?

A. Pressure

B. temperature

C. density

D. mass of air molecules

B

28. When a fixed mass of air is compressed rapidly,

A. its internal energy decreases

B. its molecules move faster

C. its density decreases

D. it cools faster

B

29. A man of mass 50 kg climbs 30 steps upstairs. If each step is 20 cm high, the potential energy gained is

A. 100 J

C

B. 1500 J

C. 3000 J

D. 300000 J

30. The refractive index of glass is 1.5 Calculate the angle of incidence for which the angle of refraction of light is 30º

A. 19.5º

B. 35.3º

C. 41.8º

D. 48.6º

D

31. On a cool day, a metal feels cold to the touch because

A. metals contain less heat

B. the temperature of the metal is the same as that of the surroundings

C. the temperature of the metal is less than that of the surroundings

D. the metal conducts heat away from the hand.

D

32. If the forces acting on a body moving along a level straight track are equal and opposite, the body

A. decelerates uniformly

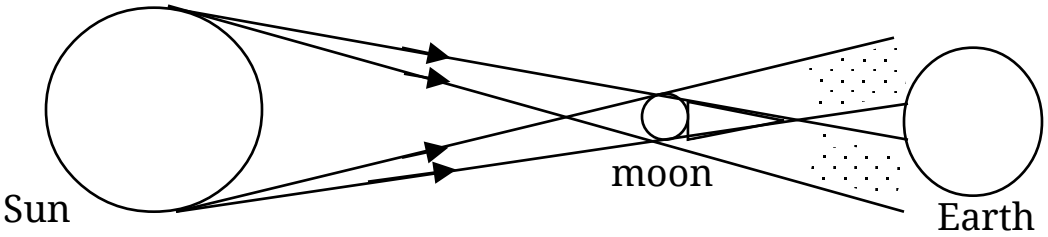
B. accelerates uniformly

C. turns into circular motion

D

D. moves with a constant speed

33.



The diagram above illustrates

A. lunar eclipse

B. solar eclipse

C. annular eclipse

D. partial eclipse of the moon.

C

34. In which one of the following sets are the radiations arranged in their order of increasing wavelength?

A. Ultraviolet, infrared, X-rays

B. Infrared, visible light, ultraviolet

C. Ultraviolet, visible light, infrared

D. X-rays, infrared, visible light.

C

35. The area between a velocity-time graph and the time axis for a moving body represents

A. distance

A

B. acceleration

C. momentum

D. velocity.

36. Water waves travel a distance of 72 cm in 6 s. if the separation of the successive crests is 3.0 cm, find the frequency of the waves.

A. 0.25 Hz

B. 4.00 Hz

C. 24.00 Hz

D. 36.00 Hz.

B

37. Sound waves are different from light waves because

A. light waves travel through glass but sound waves do not

B. light waves are reflected but sound waves are not

C. sound waves are refracted but light waves are not

D. sound waves require a material medium but light waves do not

D

38. which of the following is true about a simple cell?

A. the anode is made of zinc while the cathode is made of copper

B. the solution consists of dilute hydrochloric acid

C. copper dissolves in the acid forming a salt

D

D. the negatively charged acid ions move towards the zinc plate

39. The SI unit of electric current is

A. milliampere

B. ampere

C. volt

D. coulomb

B

40. The particles found in the nucleus of an atom are

A. electrons only

B. protons only

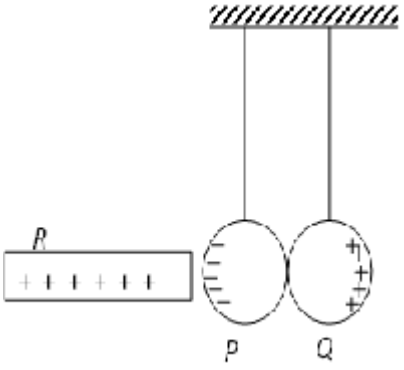
C. electrons and protons

D. protons and neutrons.

D

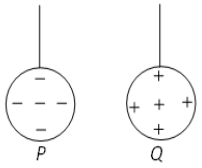
SECTION B

41 (a)The figure shows a positively charged glass rod R brought near two metal spheres P and Q in contact.



(i) mark on the diagram above, the charges induced on spheres P and Q in their exact positions. (01 mark)

(ii) If the spheres are separated and then R is removed, draw the diagrams of the separate spheres P and Q, sh



owing the charges on each of them.(2 marks)

(b) State the material that was rubbed with *R* in (a) above in order to acquire that charge. **SILK**

42.(a) State the fundamental law of electrostatics (01 mark)

like charges repel unlike charges attract

(b) (i) Explain what is observed when a positively charged rod is brought near the cap of an uncharged gold leaf electroscope.
(2mks)

The gold leaf diverges.This is because a positive charge is induced on the brass plate as well as on the gold leaf. Repulsion between the plate and the leaf occurs causing the gold leaf to diverge.

(ii) What will happen to the electroscope when the rod in b(i) above is then made to touch the cap briefly and then taken away.
(1 mark)

There will be a decrease in divergence.

(*The negative charge on the brass cap gets neutralised.*

When the charged body is taken away, the charge on the leaf and on the plate distributes itself all over the brass rod and the cap, reducing the charge density on the leaf and the plate; hence the repulsive force reduces resulting in a slight decrease in divergence.) Explanation is not required.

43.(a) (i) Define saturated vapour pressure. (1 mark)

Saturated vapour pressure is the presssure exerted by the vapour which is in contact with its own liquid.

(ii) Why is cooking faster in a pressure cooker? (1 mark)

Cooking is faster in a pressure cooker because it takes place at a higher temperature than normal.
The pressure inside the cooker is high resulting in correspondingly high saturated vapour pressure. This makes the boiling point of water to be higher than the ordinary boiling point outside the cooker.

(b) The volume of a fixed mass of a gas is 150 cm^3 at a temperature of 27ºC. If the pressure remains constant, what will be the volume at 127ºC? (2 marks)

V_1 = 150 cm^3 T_2 = 127ºC = 400 K

T_1 = 27ºC = 300 K. V_2 = ?

$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = \frac{V_1 T_2}{T_1}$ **Hence** $V_2 = \frac{150 \times 400}{300}$ **= 200 cm^3**

44.(a) The specific heat capacity of a metal is given as 500 J kg^{-1} K^{-1}.

What does this mean? (1 mark)

It means that when 500 joules of heat energy is absorbed by 1 kg of a metal the temperature of the metal increases by 1 kelvin.

(b) 0.5 kg of aluminium at a temperature of 100ºC is placed in 1.0 kg of water at 20ºC. Assuming no thermal heat is lost to the surroundings, what will be the final steady temperature of the aluminium-water mixture?

(Take specific heat capacity of aluminium = 900 J kg^{-1} K^{-1}) (3 marks)

m_a = 0.5 kg, c_a = 900 J kg^{-1} K^{-1}, θ_3 = 373 K, θ_2 = ?, c_a = 900 J kg^{-1} K^{-1}, m_w = 1 kg, c_w = 4200 J kg^{-1} K^{-1}, θ_1 = 293 K

Heat given out by aluminium = heat gained by water

$m_a c_a(\theta_3 - \theta_2) = m_w c_w(\theta_2 - \theta_1)$

$0.5\times900\times(373 - \theta_2) = 1.0\times4200\times(\theta_2 - 293)$

$450\times(373 - \theta_2) = 4200\times(\theta_2 - 293)$

$373 - \theta_2 = 9.33\times\theta_2 - 9.33\times293$

$10.33\theta_2 = 3107$ **Hence** $\theta_2 = 300.8$ **K or 27.8°C**

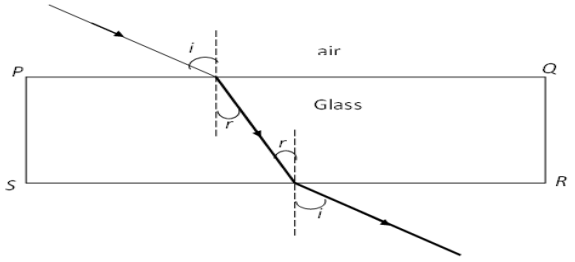
45.(a) State the laws of refraction.
(2 marks)

Law 1 **The incident and refracted rays are on opposite sides of the normal at the point of incidence and all three lie in the same plane.**

Law 2
The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant for a given pair of media.

(b)

Complete the diagram above by tracing the path of light which is incident on face *PQ* of the glass block until it emerges out of glass at face *RS*. (2 marks)



46.(a) What is a stationary wave?
(1 mark)

A stationary wave is the one whose wave profile does not move.

Or the wave formed when two identical waves travelling in opposite directions are superimposed.

(b) What is meant by **nodes** as applied to a stationary wave? (1 mark)

Nodes are the points in a stationary wave which do not vibrate.

(c) The distance between four successive nodes on a stationary wave is 12 cm. Find the wavelength of the wave. (2 marks)

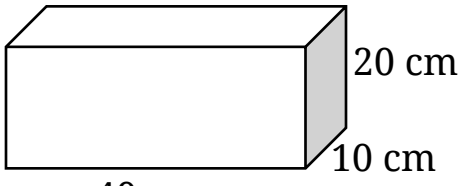
1.5 λ **= 12**

λ **=** $\frac{12}{1.5}$ **= 8 cm**

47. (a) State **Pascal's principle**. (1 mark)

When a fluid completely fills a vessel, and a pressure is applied to it at any part of the surface, that pressure is transmitted equally throughout the whole of the enclosed fluid.

(b)



The figure above shows made of a material whose density is 1250 kg m^{-3} and it measures 10 cm × 20 cm × 40 cm.

Find

(i) the mass of the block. (2 marks)

ρ **=** $\frac{m}{v}$ **where** ρ **is density,** ***m*** **is mass and** ***v*** **is volume.**

$m = \rho \times v$

$m = 125\ 0 \times 10 \times 20 \times 40 \times 10^{-6} = 10\ kg$

(ii) the maximum pressure it exerts. (1 mark)

$P = \frac{F}{A}$ **where *F* is force, *A* is area and *P* is pressure**

$P = \frac{10 \times 10}{10 \times 20 \times 10^{-4}} = 5000\ N$

48.(a) Name two physical properties which change with temperature. (1 mark)

I. **Size; the volume of a fixed mass of a gas may increase or decrease with temperature change.**

II. **Pressure of a fixed mass of a gas; the pressure may increases or increase with temperature rise.**

III. **Change of state; e.g. melting or freezing.**

(b) Convert a temperature of – 25ºC to kelvin. (1 mark)

– 25 + 273 = 248 K

(c) Explain why evaporation causes cooling. (2 marks)

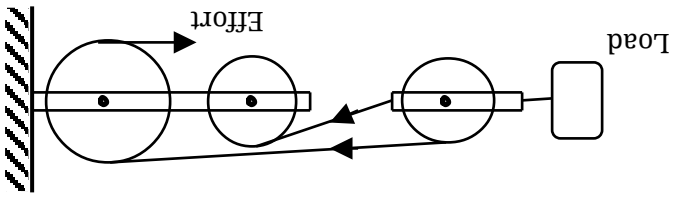
The evaporating liquid obtains latent heat of vaporization from the material it is in contact with. Since the material loses heat, its temperature falls, hence cooling.

49.(a) What is meant by efficiency of a machine? (1 mark)

The efficiency of a machine is the ratio of the useful work output to the total work put into the machine.

(b) Draw a simple pulley system of velocity ratio 3.

(2 marks)



(c) Give one practical application of pulleys. (1 mark)

- **Pulleys are used in cranes to raise materials to higher levels at construction sites.**
- **They are used in lifts to transport passengers upstairs or downstairs.**
- **They are used in elevators to move cargo from one point to another.**
- **They are used in window curtain rails to draw curtains, flag poles to raise flags ,e.t.c**

50.(a) What is meant by

(i) mass number? (1 mark)

Mass number is the number of protons and neutrons in the nucleus of an atom.

(ii) atomic number? (1 mark)

Atomic number is the number of protons in the nucleus of an atom.

(b)Name two radiations emitted by radioactive substances.(2marks)

Gamma radiation, or γ – radiation,

Beta radiation, or β – radiation,

Alpha radiation, or α – radiation.

END