

Item 1.

A farmer dealing in the grafting of coffee seedlings realized that the grafting scissors used were no longer providing an efficient force to cut the grafting stems appropriately. The farmer is advised by the technician to replace the spring in the grafting scissors to make them more efficient. **Figure 1** shows the grafting scissors whose spring is to be replaced. The technician recommends a replacement of the spring with another **one** of force constant between $18 \text{ Nm}^{-1} - 25 \text{ Nm}^{-1}$. The springs available on market found by the farmer *did* not have the specified force constants labelled. Therefore, this necessitates for a scientific investigation.

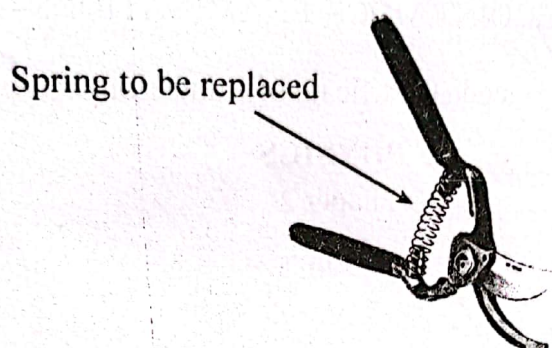


Figure 1: Grafting Scissors.

Task:

As a physic student, you are provided with a spring of similar physical properties and dimensions as the **one** found by the farmer in the market. Carryout a scientific investigation to determine the force constant of the spring provided and advise the farmer whether it is appropriate to replace the one in the grafting scissors. **Figure 2** gives an illustration of the scientific setup having other materials that can be of use during the scientific investigation.

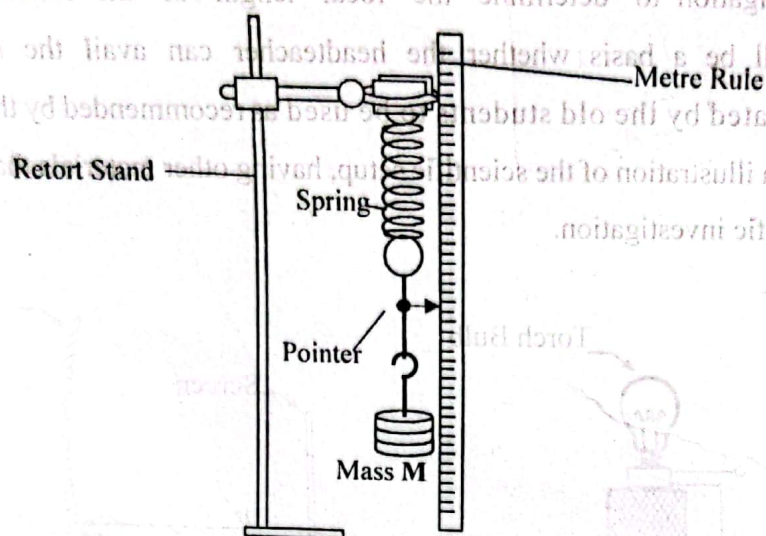


Figure 2: Illustration of the Scientific setup.

Hint: Appropriate and neat recordings of your investigation are necessary.

Item 2.

A school nurse carried out a study on the symptoms exhibited by students in the sickbay. The nurse recommended to the headteacher that students should wash their hands with warm water after visiting the school latrines. This was aimed at reducing diarrhoea among the school students' population. To achieve this, the headteacher was advised to put up a water heating system that uses a concave solar concentrator. The appropriate concave solar concentrator that concentrates incident radiations at its focal point ranges from **80cm** to **220cm** of its reflecting surface. The headteacher does not know whether the available concave solar concentrator that was donated by the old students of the school can be used. Therefore, the headteacher seeks to be scientifically advised about the available solar concave concentrator in the school.

Task:

You have been provided with a concave mirror whose focal length is $\left(\frac{1}{10}\right)^{th}$ of the focal length of the available solar concave concentrator. As a student of physics, carry out a

scientific investigation to determine the focal length of the concave mirror. The investigation will be a basis whether the headteacher can avail the solar concave concentrator donated by the old students to be used as recommended by the school nurse. **Figure 3** gives an illustration of the scientific setup, having other materials that can be of use during the scientific investigation.

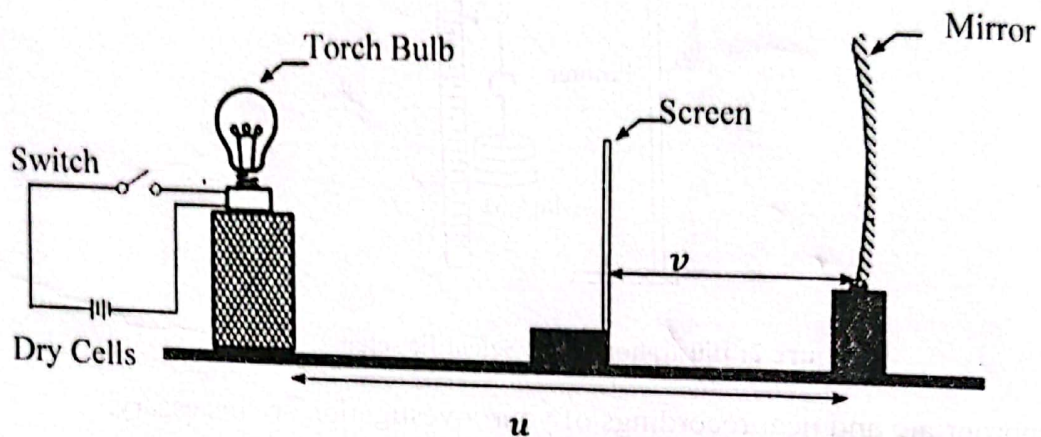


Figure 3: Illustration of the Scientific setup.

Hint:

- (i) Where necessary a student can use $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

f = focal length

u = object distance from the mirror

v = image distance from the mirror

- (ii) Appropriately and neat recordings of your investigation are necessary.

END

ma35e

ma35e

535/2
PHYSICS
PRACTICAL
SCORING GUIDE

ITEM 1

NO.	BASIS OF ASSESSMENT	EXPECTED RESPONSES	CODE	SCORING CRITERIA (key points)	SCORE	TOTAL SCORE
1	AIM	A scientific investigation to <u>determine the force</u> constant of the spring provided and <u>ascertain whether its appropriate for use in the</u> grafting scissors	A	Complete, correct (02) Partial, correct (01) No/ wrong aim (00)	02	02
2	HYPOTHESIS	The force constant of the spring provided is in the range of 18 Nm^{-1} - 25 Nm^{-1}	H	Complete, correct (01) No, wrong hypothesis (00)	01	01
3	VARIABLES <i>dependent</i> <i>independent</i>	Independent (Mass, m) (<i>extension</i> predicted) Dependent Controlled (<i>Initial position of the pointer</i>) <i>Controlled</i> <i>wind, initial position.</i>	<i>V_i</i> <i>V_d</i> <i>V_c</i>	Correct, relevant (01) Correct, relevant (01) Controlled, relevant (01) No, wrong variable (00)	03	03
4	APPARATUS	Metre rule, Retort stand with a clamp, the spring with a pointer, <i>mass, piece of wood</i>	Ap	Relevant, correct, complete (3-5) Relevant, correct partial (1-2) No, wrong apparatus (00)	02	02
						08

5	PROCEDURE	Coherence- No expected responses, coherence is determined by assessor's judgement	All coherent (4-8)	02	02
			Partial coherent (1-3)	01	
		No coherence	(00)	00	
		The experimental set up is assembled as shown. The initial position of the pointer is noted(read and recorded). A known mass, m is suspended from the free end of the spring. The new position of the pointer is noted.	Complete, correct, relevant (5-8)	03	03
		The extension produced is calculated.	Partial correct, relevant (3-4)	02	
		The experiment is repeated for different values of the mass. The results are tabulated. A graph of mass against the extension is plotted.	Partial correct, relevant (1-2)	01	
		The experiment is repeated for different values of the mass. The results are tabulated. A graph of mass against the extension is plotted.	No/wrong procedure (00)	00	
7	DATA PRESENTATION	Table of results of at least 3 columns	Correct (1-1)	01	01
		Labeled columns with quantity and unit	Correct (1-3)	01	01
		$m(g)$, new position(cm), extension produced(cm)	Correct (1-3)	01	01
		Sets of data presented	sets of data (≥ 3)	03	04
			correct (2)	02	
			sets (1)	01	
			Initial position of point	01	
		Accurate data, correctly recorded (decimal places and significant figures)	Complete correct (≥ 3)	02	02
			Partial correct (1-2)	01	
			No/ wrong data (00)	00	

correctly tabulated working diagram

8	DATA ANALYSIS	Graph with labeled axes and title	G ₁	Correct	(1-3)	01	01
		any one Plotting of points and line of best fit with dashed line, No scribble		No/ wrong labels	(00)	00	
		Slope calculation		Correctly plotted points	(1-3)	01	
		Accuracy of slope value and unit conversion		Line of best fit	for each two correctly plotted	01	
6	ERRORS & PRECAUTIONS	All relevant suggested sources of errors (internal and external factors)	E ₂	No/ wrong plotting	(00)	00	02
		All relevant suggested precautions and mitigation measures		Correct slope calculation		01	
				No/ wrong calculation		00	
				Accurate math computation		01	
9	ADVISE CONCLUSION	Advise linking the findings to the hypothesis and aim of the investigation	A ₃	No/ wrong maths		00	01
				Possible errors	(≥ 2)	02	
				Possible errors	(1)	01	
				No/ wrong errors suggested	(00)	00	
			M	Possible precautions	(≥ 2)	02	02
				Possible precautions	(1)	01	
				No/ wrong precautions	(00)	00	
				Correct/complete conclusion based on findings		02	
			A ₀	Partial correct		01	02
				No/ wrong conclusion		00	

total

34

Errors
- math
- physics

NO.	BASIS OF ASSESSMENT	EXPECTED RESPONSES	SCORING CRITERIA (key points)	SCORE	TOTAL SCORE
1	AIM	A scientific investigation to <u>determine the focal length</u> of the concave mirror and <u>ascertain whether the Headteacher can use the concentrator for the intended Purpose.</u>	Complete, correct (02) Partial, correct (01) No/ wrong aim (00)	02	02
2	HYPOTHESIS	The focal length of the concave concentrator is in the range of 80 cm to 220 cm	Complete, correct (01) No, wrong hypothesis (00)	01	01
3	VARIABLES	Independent (object distance, u) Dependent (image distance, v) Controlled (light intensity in the room)	Correct, relevant (01) Correct, relevant (01) Controlled, relevant (01) No, wrong variable (00)	03	03
4	APPARATUS	Metre rule, torch bulb, dry cells, white screen, mirror in a holder, wires, cell holders, switches, <i>wireman burner</i>	No, wrong apparatus (00) Relevant, correct partial (1-2)	02	02
5	PROCEDURE	Coherence- No expected responses, coherence is determined by assessor's judgement <i>Drawn a</i> <i>Coherence- No expected responses, coherence is determined by assessor's judgement</i>	All coherent (4-8) Partial coherent (1-3) No coherence (00)	02	02

Lab 1 (partial) - 01
 Lab 2 (partial) - 02
 Lab 3 (partial) - 02
 Lab 4 (partial) - 02
 Lab 5 (partial) - 02

marks

PROCEDURE (Continued)		Procedure as presented by candidate.					
6	DATA PRESENTATION	Table of results of at least 4 columns	P_1	Complete, correct, relevant (5-8)	03		
		Labeled columns with quantity and unit	T_1	Partial correct, relevant (3-4)	02		
		$u(cm)$, $v(cm)$ - must be seen	T_2	Partial correct, relevant (1-2)	01		
		Sets of data presented	T_3	No/wrong procedure (00)	00		
		Accurate data, correctly recorded (decimal places and significant figures)	A_1	Correct (1-4)	01		01
7	DATA ANALYSIS	Graph with labeled axes and title	G_1	Correct (≥3)	02		02
		Plotting of points and line of best fit	G_2	Partial correct (1-2)	01		
		Slope calculation, calculation of focal length of the concentrator (marked as slope)	A_2	No/wrong data (00)	00		
		Accuracy of slope value and unit conversion	A_3	Correct (1-3)	01		
				No/wrong labels (00)	00		

$1/x = 1/x_1 + 1/x_2$
 $1/x = \frac{1}{x_1} + \frac{1}{x_2}$

at minimum

DATA ANALYSIS

0.5

DATA ANALYSIS

Adding Additional column $T_4 - (\text{const} - 01) \rightarrow 01$

Value/difference normalized $\rightarrow \left\{ \begin{matrix} 33-02 \\ 12-01 \\ 00-0 \end{matrix} \right\} \rightarrow 02$

method of getting mean (avg) $\rightarrow 01 \rightarrow 01$

Average of mean value $\rightarrow 01 \rightarrow 01$
05

8	ERRORS & PRECAUTIONS	All relevant suggested sources of errors (internal and external factors) — linking — feedback	EA	Possible errors (≥ 2)	02	02	
		Possible errors (1)		01			
9	ADVISE CONCLUSION	Advise linking the findings to the hypothesis and aim of the investigation <i>(Link)</i>	AD	No/wrong errors suggested (00)	00		02
				Possible precautions (≥ 2)	02		
				Possible precautions (1)	01		
				No/wrong precautions (00)	00	02	
				Correct/complete conclusion based on findings	02		
				Partial correct	01		
	No/wrong conclusion	00					

Errors

- parallel X
- light intensity
- weak pair
- failure to identify & demonstrate margin
- fail

Precautions