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MARKING GUIDE

UMTA JOINT MOCK EXAMINATIONS 2018

P530/2

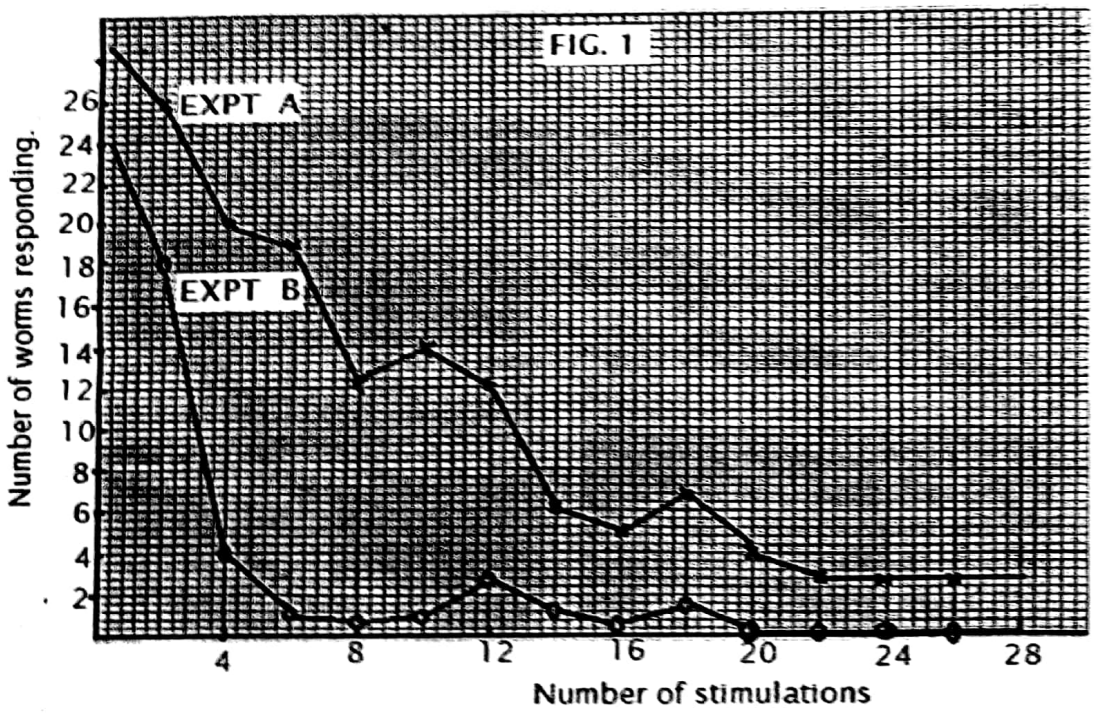
BIOLOGY PAPER 2

SECTION A (40 MARKS)

1. Figure 1 shows habituation to touch by group of tube worms *Branchioma*. In this investigation, groups of worms were tested by brushing their protruding branchial crown. Two separate experiments were carried out,

In Experiment **A**, *the worms were stimulated so gently that they only responded by withdrawing slowly in their tubes.*

In experiment **B**, *the stimuli were sufficiently strong to evoke a rapid response from the worms.*



(a) **What is the effect of frequency of stimulation on the responses of the group of worms in experiment A and B. (05 marks)**

- 0.4 number of stimulations causes high number of worms responding in both experiment A and B;
- High number of stimulations of 28 causes a low number of worms responding for both experiment A and B;
- Increasing number of stimulation from 0.4 to 6, decreases the number of worms Responding for both experiment A and B;
- Increasing number of stimulations from 8 to 20/22, causes number of worms responding to rise and fall/fluctuates for both experiment A and B;
- Increasing number of stimulations from 22 to28 , has no effect on the number of worms responding/causes the number of worms responding to remain constant for both experiment A and B;

@ 1 mark = 05 marks

(b) Explain,

(i) the differences in the effects of intensity of stimulation on the number of worms responding in both experiment A and B. (10 marks)

Gentle/weak stimulation causes a higher number of worms responding; this is because weak/gentle stimulations does not easily generate high frequency impulses; in receptors and synapses; resulting into few receptors in few worms to adapt/fatique;allowing more worms to continue responding ;

Strong stimulation lowers the number of worms responding ; this because strong stimulations are capable to generate high frequency impulses in the receptors and synapses ;which may result into many receptors and synapses to easily adapt in many worms ; preventing transmission of Impulses ; and few worms show responses towards strong stimulations ;

@ 1 mark = 10 marks

(b)Explain,

(ii) Responses of group of worms in both experiments A and B beyond 22 number of stimulations. (07 marks)

In both experiment A and B, the number of worms responding remained low and constant between 22 and 28 number of stimulations ; high number of stimulations/repeated stimulations ; generate high frequency impulses ;this causes few sodium ions to diffuse

inside receptor cells ; while high frequency stimulation prevents secretion of neurotransmitters from the presynaptic knob/exhaustion of neurotrasmitters at the synapse ; threshold may not be reached and no action potential generated ; and no further responses by the worms towards repeated stimulations;

@ 1 mark = 07 marks 08

(c) **What advantages do Habituation provide to animals.(04 marks)**

- Avoids wastage of energy on stimuli neither harmful nor beneficial ; instead energy is saved and used for other important processes like search for food/feeding/reproduction/growth and development/escape from predators ;
- Enables quick escape from danger ;
- Repeated stimulation is ignored, preventing fatigue ;
- It enables individuals to survive in environmental situations with repeated and disturbing stimuli like noisy industrial areas/smelly places ; / adaptations to stimuli

@ 1 mark , max = 04 marks

any

In another experiment, two groups of rats were previously fed and placed to spend sometime in the maze before the experiment. When the experiment begun, each group of rats were separately introduced into maze from the start and allowed to run about in the maze.

Group 1 were given food whenever they succeeded to exit the maze every day. (reward)

Group 2 were not given food as they exit the maze until the seventh day of the experiment. (no reward)

The number of blind routes made by the groups of the rats in the maze as they traverse was recorded as the error score. The result of this experiment is shown in figure 2.

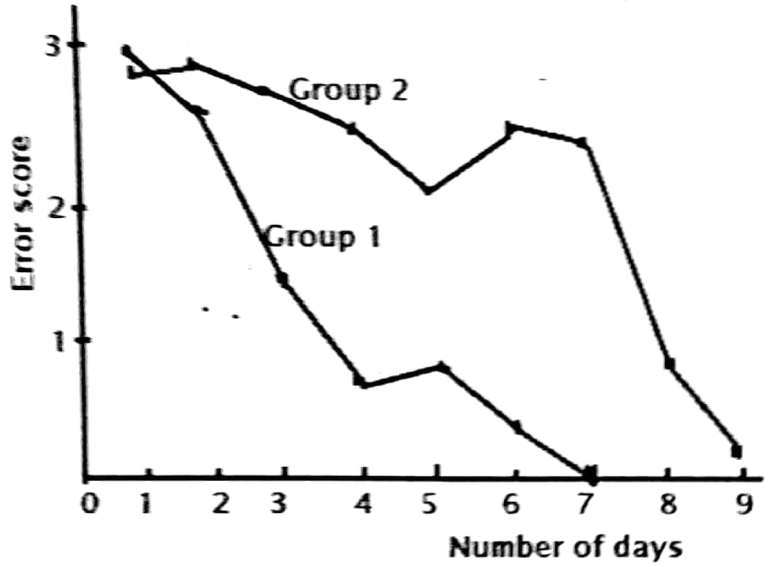


FIG. 2

(d) Account for the errors made by each of the groups of rats while traversing the maze.

(i) Group 1. **(05 marks)**

(ii) Group 2. **(06 marks)**

d(i)Initially at day 1, the number of error scored by rats in group 1 was high in rats in group 2 because the ratshad not stored enough information about the routes in the maze;

Between 1 and 4 days error scored by the rats in group 1 declined/decreased more rapidly and between 5 and 7 days error scored by the rats in group 1 declined rapidly; this is because the rats stored rapidly much information in the brainabout the routes in the maze;because the rats were motivated by the constant reward provided ;then the rats learnt faster traversing the routes making less errors/less blind routes until no errors by day 7;

More gradual increase in error score by the rats between 4 and 5 days; arises from the occasional very few blind routes made by the rats during the experiment;
@ 1 mark, max = 05 marks

d(ii) From 1 and 2 days Error score by the rats in group 2 remained constant; and then between 2 and 5 days the error score by the rats in group 2 decreased/declined gradually; the rats are slowly storing information in the brain about the routes in the maze; because the rats were not motivated by any reward; (and they consequently learnt slowly to successfully traverse the routes)

From 7 to 9 days the error score by the rats in group 2 declined rapidly; this is because the rats are using much information stored in their brains about routes in the maze to traverse it/due to exploratory learning;

Between 5 and 6 days error scored increased gradually; by the rats in group 2 due few occasional blind routs made by the rats during the experiment;
@ 1 mark = 06 marks

(e) From the information in figure 2. State any three ways intelligence of ananimal can be determined. (03 marks)

- The duration of time/days taken to cease errors score (with reward; and without reward);
- The rate at which the errors scored decline with and without reward;
- The duration it takes to remember and accomplish the task without trials;
- The complexity of the routes in the maze it traverses;

@ 1 mark, max = 03 marks

TOTAL MARKS = 40 MARKS

SECTION B (60 MARKS)

2. (a) Describe series of events, likely to occur when glycogen store in the mammalian liver is depleted. **(06 marks)**

glucose level in blood reduces below the normal ; the hypothalamus detects; and stimulates pituitary gland to secrete adrenocorticotrophic hormone (ACTH) ; which stimulates the adrenal cortex ; to secrete glucocorticoid hormone cortisol ; this stimulates the liver to convert aminoacids and glycerol into glucose ; the levels of glucose is brought back to normal ;

@ 1 mark = 06 marks

(b) Explain roles played in osmo-regulation by specific protein molecules secreted in humans. **(08 marks)**

The hormones, anti-diuretic hormone (ADH)/vasopressin and aldosterone are two protein molecules ;

When salt concentration in blood is high ; Anterior lobe of pituitary gland secrete antidiuretic hormone into blood stream ; In the kidney, ADH stimulates the walls of collecting duct and distal convoluted tubule to become more permeable to water and urea ; causing more water to be reabsorbed back into blood stream ;

And when concentration of sodium is low in blood, less water enters blood, reducing blood volume and pressure; this results into the secretion of aldosterone from the adrenal cortex into the blood stream; this causes more sodium to be reabsorbed back into blood ; causing large influx of water into blood ;

@ 1 mark = 08 marks

(c) What are the advantages and disadvantages of a mammal excreting nitrogenous waste inform of,

(i) ammonia. (03 marks)

(ii) Trimethylamine oxide. (03 marks)

Advantages of excreting nitrogenous waste inform of ammonia,

- Ammonia is excreted by simple diffusion ; which is a passive process that does not utilize energy ;

Disadvantages of excreting nitrogenous waste inform of ammonia,

- Ammonia is very soluble and highly toxic it requires a lot of water for its excretion; which could result into dehydration of the body tissues;

@ 1 mark, max = 03 marks

Advantages of excreting nitrogenous waste inform of trimethylamine oxide,

- It is soluble but less toxic and less water is required for its excretion; so conserves water in the body of marine bony fish;

Disadvantage of excreting nitrogenous waste inform of trimethylamineoxide is that it accumulates in the body of dead fish, giving off a characteristic unpleasant odour;

@ 1 mark, max = 03 marks

TOTAL = 20 MARKS

3. (a) How do the following contribute to the flight in large winged insects.
   (i) Flight muscles. (05 marks)
   (ii) aerofoil nature of the insect's wings. (05 marks)

a(i)Nerve impulses stimulate alternate contractions and relaxations of two types of antagonistic flight muscles, ~~pectoralis major and pectoralis minor;~~ direct and indirect muscles; Indirects muscle has two sets of muscles longitudinal and dorso-ventral muscles; when dorso-ventral muscles contract, longitudinal muscles relax; the tergal attachment of the wing is pulled downwards relative to pleural attachment; which results in the wings going up; up and down movement;

~~When pectoralis major contracts, pectoralis minor relaxes; the wing is pulled down wards/down stroke occurs; and when pectoralis minor contracts, the pectoralis major relaxes and the wing is pulled upwards/upstroke occurs/recovery phase occurs; rapid and continous upstroke and down stroke results into flapping; the powerful down stroke act against air resistance that may result into a lift force; the activities of the pectoralis muscles may also results into hovering/soaring.~~ When longitudinal muscles contract, dorso-ventral muscles relax; Concavity of the wing is increased; and the tergal attachment rises relative to pleural attachment which results in the going down; Continuous movement up and down of the wings results into flight;

@ 1 mark, max = 05 marks

a(ii)The upper leading edge of the wing of a ~~bird~~ insect which is broader, convex, with smooth surface moves in air at an angle(angle of attack) to air stream; compared to the lower and trailing surface which is concave/giving aerofoil appearance to the wing; during flapping, air flows faster over the upper surface than at the lower surface; this creates a higher air pressure below the wings and lower air pressure above the wings; the pressure gradient is resolved into a lift force; and the ~~bird~~ insect achieves flight in air.

@ 1 mark = 05 marks

(b) Explain how modifications of plant organs provide support. (10 marks)

Xylem vessels/tracheids/sclerenchyma are found at the central regions of the roots; and in the mid-ribs/net veins of leaves; they are arranged in ring forms or scattered in the stems of plants; they are highly lignified; adding extra mechanical strength.

Stems of herbaceous plants contain numerous thin walled parenchyma cells; when these cells are fully filled with water they become turgid; providing extra support.

Collenchyma located at the periphery in the cortex (cortical regions) of the roots/stems/leave cells have extra cellulose deposited at their corners; for extra strength.

Roots of some plants develop into prop roots like maize plant/buttress roots/deep roots; for firm anchorage; providing support.

Leaves of some plants like passion fruits; develop into tendrils to wind around stems or other structures; to provide support.
Some plants posses stems which are big to support the shoot system of the plant;

@ 1 mark, max = 10 marks

TOTAL = 20 MARKS

4. (a) Distinguish between fertilization in flowering plants and mammals. (05 marks)

Differences in fertilization between,

Flowering plants	Mammals
- Occurs in the embryo sac - Is a double fertilization/two male nuclei are involved, - Haploid male nuclei fuses with both haploid nucleus and diploid nucleus, - Zygote formed starts to develops in the embryo sac, - Leads to formation of 3n nuclei and 2n zygote	- Occurs within the ovum/egg; - Is a single fertilization/only one male nucleus is involved; - Haploid male nucleus fuses with only one haploid nucleus; - Zygote formed begins to develop within the oviduct Only 2n zygote is formed;

@ 1 mark = 05 marks

(b) Give an account of events which occur in the oviduct leading to fertilization. (08 marks)

Sperms get into contact with the secondary oocyte/the acrosome membrane of the sperm fuses with the egg next to it ; acrosome membrane ruptures releasing hydrolytic enzymes/digestive/protease ; sperm head binds to special receptors on the surface of the zonapellucida; the hydrolytic enzymes digest the path through the zonapellucida; one sperm penetrates into the cytoplasm ~~cytoplasm~~ of the secondary oocyte ; cortical granules (lysosomes) in the cytoplasm of the secondary oocyte release enzymes which cause zonapellucida to thicken and harden/fertilization membrane is formed/ the enzymes also destroy the sperm receptors on the surface membrane of secondary oocyte; the secondary oocyte undergoes second meiotic division to form haploid ovum and a polar body ; the haploid nucleus of the sperm fuses with a haploid nucleus of the ovum ; a diploid zygote is formed;

@ 1 mark , max = 08 marks

(c) What are the advantages and disadvantages of internal fertilization in mammals. (07 marks)

ADVANTAGES OF INTERNAL FERTILIZATION,

- Embryos are protected from hostile environment /predators/damage;
- Embryos easily obtain nutrients;
- High chances for fertilization/reliable/efficient;
- Reduces wastage of gametes ;
- Rapid growth due to optimum temperature;
- Promotes parental care;

@ 1 mark , max = 03 marks

DISADVANTAGES OF INTERNAL FERTILISATION,

- Embryos are vunerable to toxic chemicals produced by mother ;
- When the mother dies, the foetus also dies ;
- The foetus may contract infections from the mother ;
- Mothers are deprived of nutrients which the foetus obtain from them ;
- Delays fertilization since it relays on courtship ;
- Long gestation period causes few offsprings to be produced ;
- Mothers may be exposed to predation during periods of pregnancy ;

@ 1 mark , max = 04 marks

TOTAL = 20 MARKS

5. (a) Discuss the significance of conservation of natural resources in an ecosystem.
(09 marks)

- To pass it to the future generations for see them the way they have ever been ;
- Ensures continous supply of biological resources to human community ; such as food/medicine and industrial products ;
- Promote agriculture/forestry ; through preservation of pollinating agents and use of predators in pest control ;
- For maintenance of good climatic conditions/prevention of environmental degradation ; for example forests attract rainfalls and prevent soil erosion ;
- Habitats for many organisms are maintained ; this prevents extinction of some species of organisms ;
- Promotion of eco-tourism/Biological research ;
- Maintaining stable biochemical cycles important in nutrient recycling and undisrupted food chains ;
- Prevent environmental hazards/calamities like land slides,floods ;
- Means of transport/ medium for reproduction ;

@ 1 mark , max = 09 marks

(b) Explain the different ways by which nitrogen enters into an Ecosystem. (11 marks)

Lightening /Electrical discharges from lightening ;combine nitrogen and oxygen ;to form nitrates ~~are formed and~~ which are absorbed by plant roots ; and then converted to amino acids and proteins in plants ;

Saprophytic organisms like putrefying bacteria and fungi ; cause breakdown of proteins in dead matter to ammonium compounds/decomposes dead decaying organic matter ;

Haber process/excretion of urea/application of NPK fertilizers/sewage discharge also introduce ammonia/ammonium compounds ;

Ammonium compounds/ammonia is oxidized to nitrites ; by nitrifying bacteria like nitrosomonas and nitrococcus; nitrites are oxidized to nitrates ; by nitrobacter bacteria ; nitrates are absorbed by the plant roots ;

@ 1 mark , max = 11 marks

6. (a) How do each of the following support organic evolution,

(i) **Blood pigments.** **(04 marks)**

(ii) **Homologous organs.** **(05 marks)**

a(i) Different vertebrates like humans, birds, snakes, fish ; contain the blood pigment haemoglobin in their blood ; the blood pigment haemoglobin is also contained in blood of Annelids like the earth worms ; this is a proof that the different vertebrates had common ancestral origin ; vertebrates and annelids also have same common ancestral origin ;

@ 1 mark , max = 04 marks

a(ii) Different vertebrates like the humans, whales, monkeys, Rodents all posses homologous organs ; such organs posse same basic structures and features but perform different functions ; for example the pendactyl limbs/ears ossicles in mammals/bone jaw in fish ; the same basic structures of the homologous organs is a proof of same common ancestral origin ; the functional difference is to suit and adapt to different environmental conditions in different habitats ;

accept any other correct examples of homologous organs
@ 1 mark , max = 05 marks

(b) Discuss how each of the following factors can alter genetic equilibrium of apopulation.

(i) **Genetic drift.** **(05 marks)**

(ii) **Isolation.** **(06 marks)**

b(i) Genetic drift is sudden change in allele/gene frequency arising from sudden death of an individual ; in a small sub-population ; that occurs due to chance rather than natural selection ;loss of an individual from a sub-population who was a sole possessor of certain genes ;reduces the allele/gene frequency and the gene pool ;
@ 1 mark = 05 marks

b(ii) Isolation involves sub-population being prevented from interbreeding ; by geographical barriers like mountains, lakes/environmental conditions/reproductive barriers/seasonal changes/genetic differences ; gene flow is prevented so that each sub-population develops its own gene pool ; when mutation occurs in separate sub-population independently ;new

mutant alleles emerge ; gene/allele frequency rises and the gene pool in each sub-population becomes large ;

@ 1 mark = 06 marks

TOTAL = 20 MARKS

END.