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HOME SCHOOLING MATERIAL

PASS A' LEVEL

BIOLOGY, PHYSICS AND GENERAL PAPER

PASS A'LEVEL

YOUR GUIDE AWAY FROM SCHOOL

SOLUTIONS TO PHYSICS (APHY 003)

CONTINUATION

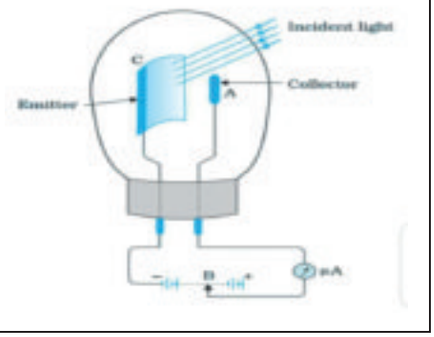
(9) (d) (i) The photocell or photoelectric cell is an electronic device that works on the principle of photoelectric effect and converts light energy into electrical energy. It consists of an evacuated glass tube containing two electrodes; the emitter or cathode (C) and Collector or anode (A). The cathode is always kept at a negative potential relative to anode.

Principle of operation

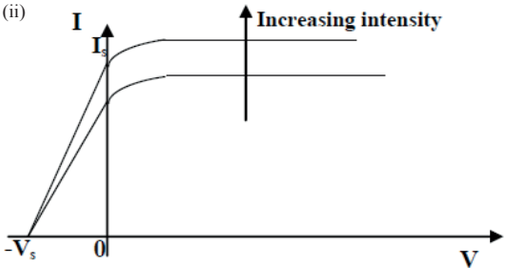
The emitter is connected to the negative terminal and the collector is connected to the positive terminal of the battery. The emitter is irradiated with a radiation of frequency higher than the threshold frequency of the material of the emitter. Photoelectric emission takes place.

The photo electrons are attracted to the collector which is at a positive potential with respect to the emitter. Thus current flows in the circuit. If the intensity of the incident radiation is increased, the photo current increases. Photo cells are applied in burglar alarms, lux meters, exposure meters, etc.

Structure of photo cell



(ii)



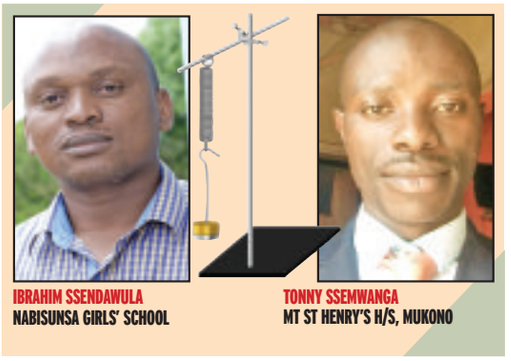
Also read about:

- Applications of photoelectric effect
- The laws/features/characteristics/main observations of photoelectric effect
- Definitions and meaning of the terms like (threshold frequency, threshold wave length, work function etc.
- The classical and quantum theories and their failures and strengths (the fact that these theories do not contradict but they are complementary)
- Einstein's equation of photoelectric effect etc.

10. (a). (i). The specific charge of an ion is the ratio of its charge to its mass.

(ii). The S.I unit of specific charge is Ckg^{-1}

(b).



IBRAHIM SSENDAWULA
NABISUNSA GIRLS' SCHOOL

TONNY SSEMWANGA
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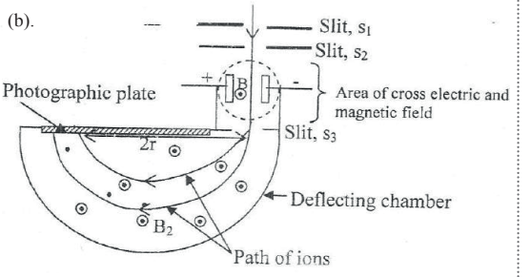
(b).



A stream of positive ions is directed through the slits S1 and S2. In the region between S_2 and S_3, cross electric and magnetic fields are applied.

At equilibrium, magnetic force on the ion is equal to electric force on the ion.

i.e. $Bqv = Eq; \quad v = \frac{E}{B} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$

Ions passing through S_3 have same velocity. So the region across the electric and magnetic fields is called a velocity selector.

Beyond S_3, the ions pass through a uniform magnetic field of intensity B_2, they are deflected in a circular path of radius r and hit the photographic plate.

The centripetal force acting on the ions in this region is provided by the magnetic force on the ions.

This implies that: $B_2qv = m\frac{v^2}{r}$

$\Rightarrow \quad v = \frac{B_2qr}{m}$.....(ii)

Equating Eq (i) and (ii), $\frac{E}{B} = \frac{B_2qr}{m}$

$\rightarrow \frac{q}{m} = \frac{E}{BB_2r}$

So if E, B, B_2 and r are known, then the specific charge of the ions can be determined.

(b). $B_1qv = Eq \qquad => V = \frac{E}{B_1}$

The centripetal force is provided by the magnetic force

$B_2qv = \frac{mv^2}{r}$.....(i)

$\Rightarrow \quad B_2 = \frac{mv}{rq}$.....(ii)

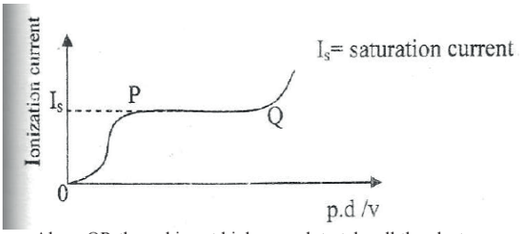
Putting Eq (a) into (b), we obtain $B_2 = \frac{2.0x10^{-26}x1x10^4}{2.1x0.75q}$...(iii)

But the beam is singly ionized.

This implies that q = 1.6 x 10^{-19} C..... (iv)

$\Rightarrow$ Substituting for q in (iii) gives: $B_2 = 1.667x10^{-2}T$

(c)(i)



Along OP, the p.d is not high enough to take all the electrons and the positive ions to their respective electrodes before recombination occurs.

Along PQ, the p.d is large enough to prevent recombination but is not sufficient to cause secondary Ionisation. So the current reaches the saturation value.

Beyond Q, there is secondary Ionisation and a point is reached when the current grows uncontrollably. At this point, the gas is said to have broken down.

(ii). Explanation of the use of an ionizing chamber to detect ionizing radiation

The ionizing radiation enters the chamber through the wire gauze and forms ion pairs due to Ionisation by collision with the gas molecules. The applied p.d enables the electrons and positive ions to move to the anode and cathode respectively.

This causes a current to flow in the external circuit; i.e., Ionisation current is detected by the amplifier or pulse electroscope.

Also read about:

- Positive rays
- The unified atomic mass unit (U)
- The Bainbridge mass spectrometer and how it is used to:
  - Determine the atomic mass of ions
  - Determine the specific charge of ions
  - Identifying the isotopes
- Binding energy and Einstein's mass- energy relation

PHYSICS QUESTIONS (APHY 004)

Acceleration due to gravity, g	= 9.81 m s^{-2}
Speed of light in Vacuum, c	= 3.0 × 10^8 m s^{-1}
Speed of sound in air,	= 340 ms^{-1}
Electronic charge, e	= 1.6 × 10^{-19} C
Electronic mass, m_e	= 9.11 × 10^{-31} kg
Permeability of free space, μ_o	= 4.0π × 10^{-7} H m^{-1}
Permittivity of free space, ε_0	= 8.85 × 10^{-12} Fm^{-1}
The Constant, $\frac{1}{4\pi\varepsilon_o}$	= 9.0 × 10^9 F^{-1} m

SECTION A

1. (a) (i) Define the term principal focus of a concave mirror.

(ii) Derive the equation, $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$ using a concave mirror where u, v and f have their usual meanings.

(b) Explain how a sextant can be used to measure the angle of elevation of the Sun.

(c) (i) Define the term angular magnification.

(ii) Draw a diagram to show the formation of an image of a distant object by a terrestrial telescope in normal adjustment and hence, derive an expression for the angular magnification

(d) (i) A compound microscope consists of two converging lenses of focal lengths 1.0 cm and 5.0 cm respectively. An object is placed 1.1 cm from the objective and the microscope is adjusted so that the final image is formed 30 cm from the eye piece. Calculate the separation of the lenses.

(ii) State any two differences between a compound microscope and an astronomical telescope.

2. (a) Define the term refractive index as applied to refraction of light.

PHYSICS QUESTIONS (APHY 004)

(b) With the aid of ray diagrams, explain the terms critical angle and total internal reflection.

(c) Figure 1 below shows a glass block 8cm thick placed in a liquid of refractive index 1.42. When a ray of light is incident on the glass at 50°, the lateral displacement in the glass is 1.76cm. Find the refractive index of glass.

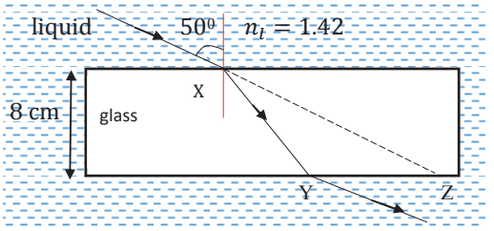


Figure 1

(d) (i) Derive an expression for the refractive index of a glass prism in terms of the refracting angle A and the angle of minimum deviation D.
(ii) Monochromatic light is incident on one refracting face of a prism of refracting angle 60^0, made of glass of refractive index 1.50. Calculate the least angle of incidence for the ray to emerge through the second refracting face.

SECTION B

3. (a) (i) What is an overtone in sound?
(ii) A string of length 1.0 m and mass 10.0 g is stretched between two fixed points. If the tension in the string is 200N, find the frequency of the second harmonic.

(b) Describe with the aid of a labelled diagram, an experiment to determine resonance of sound in air.

(c) (i) What is meant by doppler effect?
(ii) A motor cyclist and a police car are approaching each other moving at speeds of 20ms^{-1} and 30 ms^{-1} respectively. If the police siren is sounded at 600Hz, calculate the frequency of the note heard by the cyclist after the police car passes by.

(d) (i) What is meant by beats?
(ii) By using the principle of superposition of waves, explain the formation of beats.

(e) Describe the variation of pressure with displacement of air in a closed pipe vibrating with fundamental frequency.

4. (a) Describe the term diffraction of waves.

(b) By using the Huygen's principle, explain the diffraction pattern produced by a single slit.

(c) A parallel beam of monochromatic light of wave length 600mm is directed normally to a diffraction grating which has 650 lines per mm. Determine the;
(i) number of diffraction images
(ii) angle of diffraction of the highest order diffraction image.

(d) (i) Describe how polarized light can be produced by reflection.
(ii) State two uses of polarized light.
(e) State three differences between the spectra produced by a prism and a diffraction grating.

SECTION C

5. (a) Define the terms tesla and magnetic flux density.

(b) Two infinitely long straight wires carrying currents, I_1 and I_2 are placed parallel to each other in a vacuum at a distance, d metres apart. Derive the expression for the force per metre between the wires.

(c) (i) Write an expression for the magnetic flux density, B at the centre of a circular coil of N turns each of radius, r and carrying a current I.
(ii) A wire of length 12.0 m is wound into a circular coil of radius 0.15 m. If a current of 4A passes through the coil, find the magnetic flux density at the centre of the coil.

(d) (i) Describe with the aid of a labelled diagram, the structure and mode of operation of a moving coil galvanometer.
(ii) Explain the structural modification needed to convert an A.C generator to a D.C generator.

6. (a) (i) State the laws of electromagnetic induction.
(ii) Describe an experiment to verify Faraday's law of electromagnetic induction.

(b) Define the terms self-induction and mutual induction.

(c) A transformer has 3000 turns in the primary coil. The primary coil is connected to a 240V mains. A 12V, 36W lamp is connected to the secondary coil. If the efficiency of the transformer is 80%, determine the;
(i) number of turns in the secondary coil
(ii) current flowing in the primary coil

(d) (i) Explain the term back emf in a d.c motor.
(ii) State the significance of back emf in a d.c. motor.
(iii) Show how the back emf in a motor is related to the efficiency of the motor.

7. (a) Define the terms peak value and root mean square of an alternating current.

(b) A resistor of resistance 200 Ω is connected across an alternating voltage, $V = 20\pi \sin 60\,\pi t$.
(i) Find the frequency of the alternating voltage.
(ii) Calculate the mean power dissipated in the resistor.

(c) (i) An alternating voltage is applied across a capacitor of capacitance C. Show that the current in the circuit leads the voltage by $\frac{\pi}{2}$.

(ii) Find the expression for the capacitive reactance in terms of frequency, f and capacitance, C.
(iii) A capacitor of capacitance 0.2 μF is in series with an a.c source of frequency 100Hz. If the r.m.s value of the current flowing is 12 mA. Calculate the voltage across the capacitor.

(d) With the aid of a diagram, describe how a half wave rectifier type meter works.

(e) Explain the advantage of a.c over d.c in power transmission.

SECTION D

8. (a) (i) State two characteristics of an equipotential surface.
(ii) Give one example of an equipotential surface.

(b) (i) With the aid of a labelled diagram, describe the structure and action of the Van der Graaf generator.
(iii) Outline briefly the factors that limit maximum voltage obtainable in a Van de Graaf generator.

(c) Explain how two insulating bodies rubbed together acquire charge.

(d)

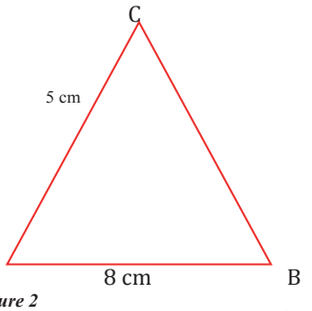


Figure 2

Figure 2 above shows two point charges A and B of +0.1 μC and +0.05 μC respectively separated by a distance of 8.0 cm along the horizontal.
Find the electric field intensity at C.

9. (a) (i) Define the term capacitance of a capacitor.
(ii) Derive an expression for the energy stored in a capacitor of capacitance, C and charged to a p.d, V.

(b) (i) Explain the effect of placing an insulator between the plates
of a charged capacitor.
(ii) What would happen if a conductor instead of the insulator was placed between the plates of the capacitor.
(iii) Give two uses of a dielectric.

(c) A capacitor of capacitance, C is fully charged from a 300V battery. It is then discharged through a small coil of wire embedded in a thermally insulated block of heat capacity 400Jkg^{-1}. If the temperature of the block rises by 0.6 K, calculate C.

(d) The circuit in figure 3 shows a network of capacitors connected across a 12 V d.c supply.

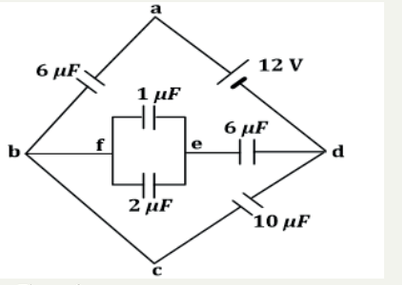


Figure 3

Determine the net charge contained in the network.

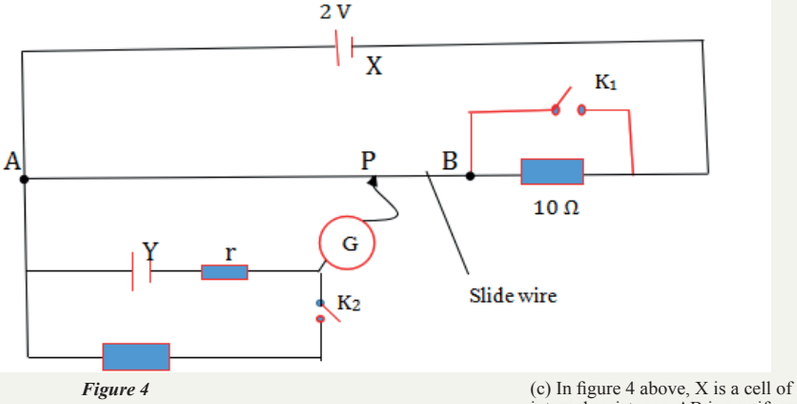


Figure 4

10. (a) (i) Define electromotive force of a battery.
(ii) A cell of emf E and internal resistance, r drives current through a resistor of resistance, R connected in series with it. Derive an expression for the efficiency of the circuit.

(b) A variable external resistance R is connected across a d.c source of e.m.f , E , having internal resistance r.
(i) Show that the maximum power output $P_{max} = \frac{E^2}{4r}$
(ii) Sketch a graph showing variation of power output against resistance.

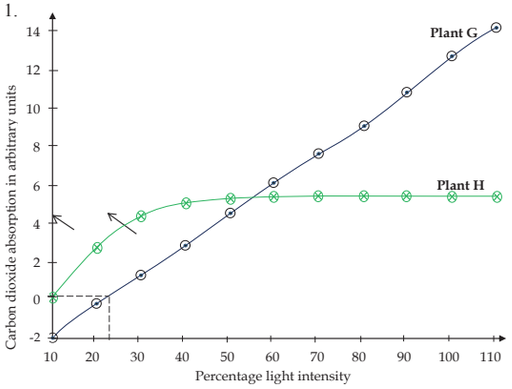
(c) In figure 4 above, X is a cell of e.m.f 2V and negligible internal resistance. AB is a uniform slide wire of length 100 cm and resistance 20 Ω. With both switches K1 and K2 open, the balance length AP = 90.0 cm. When K2 is closed and K1 left open, the balance length is 75.5 cm. Calculate the;
(i) e.m.f of cell Y
(ii) internal resistance, r of Y
(iii) balance length when both K1 and K2 are closed.

(d) Describe with the aid of a circuit diagram how you would measure the temperature coefficient of resistance of a material in form of a wire.

BIOLOGY PAPER 2 ANSWERS (ABIO 004)

SECTION A

1.



Plant G: At 10 percentage light intensity plant G had the least carbon dioxide absorption. From 0 to 110 percentage light intensity its carbon dioxide absorption increased gradually.
ii) Plant H: At 10 percentage light intensity plant H had the least carbon dioxide absorption. From 0 to 25 percentage light intensity its carbon dioxide absorption increased rapidly. From 25 to 35 percentage light intensity, the carbon dioxide absorption increased gradually. From 35 to 110 percentage light intensity its carbon dioxide absorption remained constant.

b (i) On the graph.

(ii) This is the light intensity at which the rate of photosynthesis utilizes the exact amount of carbon dioxide produced by the plant during respiration and the exact amount of oxygen produced as waste product of photosynthesis is utilized wholly in respiration without exchange of these gases with the surrounding environment.

Plant G requires a relatively higher percentage light intensity (of 33 to 34) to chemically split (photolysis) the amount of water in the thylakoid membranes of chloroplasts to produce specific amount of oxygen molecules required by the plant to satisfy the rate of respiration without releasing any excess to the surrounding.

$$2H_2O_{(l)} \xrightarrow{\text{light energy}} 4H^+_{(aq)} + O_{2\,(g)} + 4e^-$$

The total amount of oxygen produced in this process is wholly utilised in respiration.
The protons (H+) produced are just sufficient enough to reduce Nicotinamide adenine dinucleotide phosphate (NADP+) to Nicotinamide adenine dinucleotide phosphate hydrogen (NADPH2). These protons of all the hydrogen ions are used in the dark stage of photosynthesis to reduce the whole carbon dioxide from respiration to produce carbohydrates.

$$NADP + 2H^+ + 2e^- \xrightarrow{\text{NADP-reductase}} NADPH_2$$

(c) i) Plant G lives in open/sunny area/area with high light intensity.
Plant H lives under shade.

ii) Plant G has higher light compensation point and its rate of carbon dioxide absorption kept increasing as light intensity increased at higher percentages.
Plant H has lower light compensation point and its rate of carbon dioxide absorption reached its maximum at relatively low light intensity.

iii) In open habitat: During early period of association, plant H would have most of its chlorophyll bleached making it look pale green. Its rate of photosynthesis would be low. Due to little food produced, the plant would have a stunted growth. Meanwhile, plant G would have high light and carbon dioxide absorption. Its rate of photosynthesis would be high – hence much food would be produced. This results in rapid growth due to abundant food available for its metabolism. Eventually plant G would cast shade over plant H, which would begin to resynthesize more chlorophyll to increase on its rate of light absorption – hence increasing the rate of photosynthesis. Subsequently, much food would be available to increase metabolism resulting in rapid growth once again.

In shaded habitat: During early period of association, plant G would have low light and carbon dioxide absorption. Its rate of photosynthesis would be low. Due to little food produced, the plant would have a stunted growth. Meanwhile, plant H would have optimum light and carbon dioxide absorption. Its rate of photosynthesis would be high – hence much food would be produced. This would result in rapid growth due to abundant food available for its metabolism. Plant H would cast more shade over plant G, which would have low ability to produce much chlorophyll and becomes etiolated. Plant G would die over long time of association.

(d) i) Temperature
ii) Reactions during photosynthesis are catalysed by enzymes such as ATP synthase/ ATPase, RUBP carboxylase / RUBISCO enzyme, PEP carboxylase, oxalo-acetate hydrogenase, and malate decarboxylase. At this light intensity the temperature could have been lower than the expected optimum. Some of these enzymes were inactive that reduced the rate of formation of intermediates of the respective products of photosynthesis.

SECTION B

2. (a) They are equipped with the following adaptations:
- Most of the predators have high sense of smell due to concentration of olfactory glands in the nostrils. They use this to detect preys from long distances or even when the preys passed the site sometime back.
- Many have the sizes of pinnae (earlobes) being large to direct much sound waves into the ears, giving them acute sense of hearing.
- Some have eyesight that is very powerful with the retina having many rods than cones to increase its sharpness in night vision. This explains why some are good night hunters. Other secondary adaptations to improve on their vision are in having reflective layer (tapitum) behind the retina. This layer concentrates light onto the retina. Some day-light adapted hunters also have white mark below their eyes to reflect maximum amount of light while some have shaded areas around their eyes so that they are not easily recognised by their preys. This is particularly found in.
- Some have good camouflaging ability because their fur colour blends suitably with grass background (especially in dry season when the grasses are dry).
- Some like cheetah have legs that are very long with flexible joints for fast running some like leopards have short legs to lower their centres of gravity for stability during the chase.
- Most of them have flexible spine (vertebral column) flexibility in movement during the hunt.
- The heads are mainly rounded and attached to short necks with strong muscles to give powerful grip as they subdues their preys. This is the reason why some have great strength kill much bigger animals like buffalo.
- They also have enlarged and long canine teeth for firm grip of prey.
- There are also enlarged and raised cusps with deeply rooted carnassial teeth for shearing flesh and providing firm support in that process.
- Great success can also be attributed to their ability to stalk their preys. This is because of them have limbs with sharp retractable claws to leave the soft pads in between the claws. The soft pads can rest on dry leaves but produce very minimum noise that can hardly alert the prey. This system is made more efficient by the ability of the predator to lift the hind legs and rest them at the same spot where the fore legs were removed.
- The mammalian predators drink water regularly to cool themselves since too much heat is normally generated during the hunt. Another behaviour associated with this is panting so that cooler air passes over the minute blood vessels in the wet tongue to reduce body temperature.
- Majority have efficient respiratory system to give them stamina for running long distances as the preys tires. This is especially seen in hyena.
- They have abilities to instinctively:
  - use various communication methods that act as signals for group hunting
  - train their young ones with techniques of hunting.
  - time prey with the enforcement of experience and decisively attack to kill.
  - stay long without food.
  - Also their ability to digest the various food components that have been taken, including horns and bones.

(b) Some have eyes to lateral side of the head to give them lateral view that makes them to recognise predators from wide field of vision and seek escape.
- Some have their heads elevated by the long necks and can turn at ease to increase field view.
- Many have eye - sights that are powerful for both day and night vision.
- Possession of long muscular legs in some for fast running. In some species like giraffe, the heavily built muscles have powerful kicks that can kill big-sized predators like lions.
- They have fur colours that camouflage well with the background so that it becomes difficult for predators to see them or may have stripes, like in zebra, that flicker to the predators making it difficult single out one animal to attack.
- Some, like the monkeys and squirrels use intelligence by climbing to weak tree branches, which they know, cannot support heavy predators.
- Others have developed dangerous features like horns, spines and tusks for defence that can injure predators or hard shells which are too difficult to break. At times these features are only aggressively displayed to scare off the predators.
- In some cases, animals of different species aggregate to seek protection from one another. In their association they can learn to communicate to each other in case of danger or one species may be too aggressive for predator of another species - hence can defend the latter.
- Some seek protection underground which is hardly reached by the predators.
- Many can remain still for long hours so that they are not easily recognised by predators passing by.
- Most of them give birth during the hot day when the predators are inactive under shade or at night. This is followed by the mother eating away the amnion to reduce scent of the young ones from easy detection by predators.
- Some produce offensive, repellent or poisonous substances that deter the extent to which predators may attack them.
- The young ones normally develop very fast to give them the ability to escape from predators. Some are known to run in less than an hour from the time of birth.
- There is also great parental care given until the young ones are able to live an independent life. Even then such animals are known to aggregate in herds.

3. (a) Increases surface area for metabolic reactions in cells.
- Rate of metabolic reactions can be controlled inside organelles because the organelle membrane controls the entry of reactants and exit of products.
- Increases the rate of metabolic reactions because keeping enzymes for a particular metabolic reaction within an organelle maintains close proximity of the products with the next enzyme in sequence.
- Potentially harmful reactants and products or enzymes can be isolated from the rest of the cell in an organelle.

(b) (i) Has a network of interconnected flattened sacs called cisternae.
- The roughness is due presence of ribosomes which stud the membranes of the organelle.
- It is continuous with the nuclear membrane.

(ii) Having extensive network of membrane system, it provides a large surface area for chemical reactions in a cell that depend on membrane system.
- Having extensive network of membrane system also serves as a transport system within a cell to facilitate movement of materials within the cell.

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BIOLOGY PAPER 2 ANSWERS (ABIO 004)

- Having extensive network of membrane system provides cytoplasmic skeleton to the cell.
- Stud of ribosomes enable synthesis of large amounts of proteins that are secreted by the cell.
- Flattened sacs enable the reticulum to isolate and transport proteins after their synthesis in the attached ribosomes.
- Being continuous with nuclear membrane provides immediate channel for transporting the synthesised proteins.

(iii) Short chains of sugars are then linked to the polypeptide forming a glycoprotein. The ER then packages the glycoprotein in a transport vesicle. The vesicle then buds from the ER membrane and leads to the golgi apparatus for further processing. From the golgi apparatus, it can be secreted via the cell membrane. Polypeptide is synthesized in the ribosomes and it passes into the ER.

4. (a) (i) Hardy-Weinberg equation expresses allele frequency in a population as:

$p^2 + 2pq + q^2 = 1$ where p is frequency of dominant allele (W) and q is frequency of recessive allele (w).

Also the sum of the allele, $p + q = 1$

To calculate the numbers of individuals of any category, the values of p and q must be determined as:

Number of individual who can wag ears is
450 – 378 = 72 individuals.

This represents a frequency of $\frac{72}{450} = 16\ \%$, which is 0.16 of the population.

This implies that $q^2 = 0.16$

$$q = \sqrt{0.16}$$

$$= 0.4$$

Since $p + q = 1$

$$p = 1 - 0.4 = 0.6$$

The frequency of population who are heterozygous is represented by 2pq.

Therefore, $2pq = 2 \times 0.6 \times 0.4 = 0.48$

Population represented by frequency of 0.48 is

$$\frac{0.48}{1.00} \times 450 = 216 \text{ individuals}$$

(ii) Wagging ears is expressed due to homozygous recessive, ww. The frequency is represented by q^2.

Since q = 0.4, it implies that $q^2 = (0.4)^2$

$$= 0.16$$

Population represented by frequency of 0.16 is

$$\frac{0.16}{1.00} \times 450 = 72 \text{ individuals}$$

(b) The population remains large.
- There is random mating to give equal opportunity for alleles to be represented in the next generation.
- All members of the population are fertile.
- There is no pre–reproductive mortality.
- There is no overlap between generations. i.e. no individuals of the previous generation survived in the next generation.
- No migration (immigration and emigration) between this population and the neighbouring counties.
- No mutation occurs, which would reduce or increase the number of either allele.

5. (a) Isometric growth. This occurs when an organ grows at the same rate as the rest of the body. Therefore a change in size of organism is not accompanied by change in shape of the organism i.e. the relative proportions of the organs and the whole organism remain the same.
- Allometric growth. This occurs when an organ grows at a different rate from the rest of the body. This therefore produces change in shape as the size increases.
- Limited growth/definite growth/determinate growth. This is where growth of organism ceases/stops at maturity. I.e. growth does not occur throughout life.
- Unlimited growth/indefinite growth. This is growth that occurs throughout life of an organism. The growth in a new year is added to the bulk growth of previous year that was already attained.
- Intermittent growth in insects/discontinuous growth. This involves having a number of periods of extremely rapid growth followed by periods of little or no growth because of the need to shed of inelastic exoskeleton (moulting/ ecdysis) which prevents overall growth of the whole body, allowing growth to occur only in spurts.

(b) Secondary growth leads to formation of secondary xylem (wood), parenchyma rays among others. The formed xylem provides support due to large deposition of lignin in it and lateral support is provided by rays of parenchyma when fully turgid.

(c) In a short day plant
- Longer periods of light result in accumulation of phytochrome far red which in high concentration inhibits secretion of flowering hormone florigen - hence no flowering occurs.
- Shorter periods of light result in little amounts of phytochrome far red which then stimulates secretion of the flowering hormone - hence the flowering occurs.

In a long day plant
- Longer periods of light result in accumulation of phytochrome far red which in high concentration stimulates secretion of flowering hormone hence flowering occurs.
- Shorter periods of light result in little amounts of phytochrome far red which inhibits secretion of flowering hormone hence no flowering occurs.

6. (a) The coleoptiles bent towards the side without indoleacetic acid (IAA). The degree of bending increased more in coleoptiles where there was increased concentration of indoleacetic acid to a maximum at 1.3 µmole per dm3.

(b) (i) 1.3 µmole per dm3.

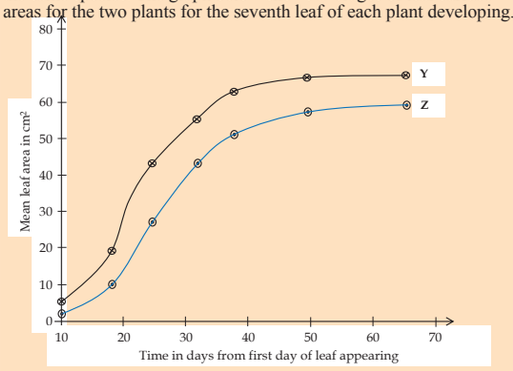
ii) At this concentration the angle of curvature in degrees is highest. This implies that the highest numbers of cells dividing and expanding.

(c) When the coleoptile is exposed to unidirectional light rays, IAA becomes distributed more on the shady side. This would affect intended control of IAA required to be on one half of coleoptile to obtain curvature in one direction only. To maintain concentration of IAA on the side it was applied no light is required.

(d) Indoleacetic acid (IAA) attaches to the receptors in the nuclei of cells. The complex activates proton (H+) pump to increase hydrogen ion concentration. The increased acidic condition in the cells makes enzymes to break hydrogen bonds in cellulose in the cell walls and the fibrils are weakened leading to loosening of cell walls with the result that cell elongation occurs. At low IAA concentration of 0.2 µmole per dm3 fewer proton (H+) pump activated and fewer hydrogen ions are pumped – hence low growth. As concentration of IAA increases more proton (H+) pump activated. This keeps on increasing the concentration and higher growth on the side it was applied.

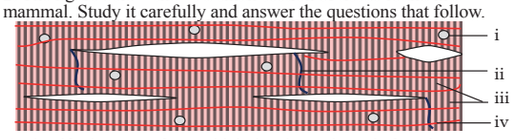
BIOLOGY QUESTIONS (ABIO 005)

1. Plant group Y were grown in atmosphere containing 400 volume parts per million (vppm) carbon dioxide while plant group Z were grown in 1000vppm carbon dioxide when all other factors in the environment were kept optimal. The two groups are annual plants of the same species. The graph below shows averages of leaf surface areas for the two plants for the seventh leaf of each plant developing.



a) Why were the seventh leaves a better choice to the first leaves?
b) Comment on the results obtained as represented by the information on the graph.
c) What conclusion can be drawn from this study?
d) Give an explanation to the results in this experiment.

2. The figure below shows a small section of tissue found in a mammal. Study it carefully and answer the questions that follow.



a) Identify the organ from which the above tissue is found.
b) Name the parts labelled (i) to (iv).
c) Describe how the tissue is stimulated to ensure efficient functioning of the organ from which it is found.

3. a) i) Suggest the contribution of Jean Lamarck in the study of evolution.
ii) What was the major weakness in his theory in building a better understanding of evolution?
b) Two species of squirrels have been found to live on opposite sides of Grand Canyon. They exhibit different sizes of heads, length of fur on ears and tails, different patterns of fur colour on the rest of the body. Several males from one group and several females from another group were once enclosed in an experimental environment with intent to interbreed them but they failed to engage in effective courtship.
i) What is the specific type of mechanism of evolution did this squirrel exhibit?
ii) Explain the mechanism of evolution you proposed in (b) (i).
c) i) What is meant by Altruistic behavior as applied in the study of evolution?
ii) Show how altruistic behaviour brings about evolution.

4. a) i) Differentiate between negative feedback and positive feedback
ii) Show two examples in each case of the feedbacks that demonstrate their importance in life.
b) Although carbon dioxide is considered to be a toxic waste of metabolism mammalian body has often relied on it to attain some metabolic balance.
i) Name one scenario where the mammalian body requires carbon dioxide for its efficiency.
ii) Which body part is involved in the process you have named in (b) (i) above.
ii) How does the body part mentioned in (b) (ii) above utilise the carbon dioxide?

5. a) For mosses and ferns to reproduce they require water medium. Explain why this is so.
b) Name the:
i) cells of a fern which undergo meiosis.
ii) structure inside which the cells named in (b) (i) above occur.
iii) collection of the structures usually visible on the surface of frond of ferns.
c) Show how the spores of ferns differ from the spores of a fern.
d) Give ways by which dormancy in mosses is seen as good survival "strategy".

6. a) Explain the measures taken in parasites consider as the main features that enable them succeed amidst challenges of accessing and living in animal hosts.
b) Compare parasitic life to saprophytic life.
c) In what ways are saprophytes important to humans?

GENERAL PAPER QUESTIONS (AGP004)

SECTION A

1. Examine the causes and effects of land conflicts in your country.
2. "Man is primarily responsible for environmental degradation in the world." Discuss.
3. Examine the causes and suggest effects of the numerous child abuse cases in your community.
4. Justify the need for preserving certain African traditional values and customs in your community.

SECTION B

Read the following information and answer the questions that follow.

Oceania Transporters and Forwarders (U) Ltd is a Trucking Company which transports goods in the whole of the East Africa. During this period of the COVID-19 pandemic, their truckers as well as others are facing a lot of criticism due to the high number of coronavirus positive cases at the numerous border points. The Ugandan government has received a special consignment of Personal Protection Equipment (PPE) at Mombasa, which must be brought into the country speedily. It has, therefore, chosen 5 of its best truckers to collect the consignment.

Wasemwa – he was born in the last month of the second quarter in the same year as Otieno. He has spent 9 years in the Company.

Buladde – he is a couple of years older than Otieno and has spent half the time in the company that Mulongo has.

Otieno – he joined the company a decade ago when he was 37 years on his birthday in April and has been working there since.

Mulongo – is the same age as Wasemwa and was born in the first month of the third quarter of the same year. However, he has spent in the company a third the time that Wasemwa has.

Pokopiki – has spent in the company twice the time that Mulongo has. This number plus four dozen is his age.

Questions

a) Draw a table to show the ages of the truckers and the time they have spent in the company.

b) Identify the trucker who has spent the:
i) least time in the Company
ii) most time in the company

c) Arrange the truckers who are agemates beginning with the youngest.

d) i) Examine the challenges faced by the long distance truckers in East Africa during this period of COVID-19 lockdown.
ii) Suggest possible solutions to the challenges that they face.

6.Read the passage below and answer the questions that follow.

I have often thought of it as one of the most **barbarous customs** in the world, considering us as civilised and a Christian country, that we deny the advantages of learning to women. We reproach the sex everyday with folly and **impertinence**, while I am confident, had they the advantages of education equal to us ,they would be guilty of less than ourselves.

One would wonder, indeed, how it should happen that women are **conversible** at all, since they are only beholden to natural parts for all their natural knowledge. Their youth is spent to teach them to stitch and sew or make baubles. They are taught to read indeed, and perhaps to write their names or so, and that is the height of a woman's education. And I would but ask any who slight the sex for their understanding, what is a man (a gentle man, I mean) good for that is taught no more?

The soul is placed in the body like a rough diamond, and must be polished, or the lustre of it will never appear: and it is **manifest** that as the rational soul distinguishes us from brutes, so education carries on the distinction and makes some less brutish than others. This is too evident to need any demonstration. But why then should women be denied the benefit of instructions? If knowledge and understanding had been useless additions to the sex, God Almighty would never have given them capacities, for He made nothing needless. Besides, I would ask such what they can see in ignorance that they should think it necessary ornament to a woman? Or what has the woman done to **forfeit the privilege** of being taught? Does she plague us with her pride and impertinence? Why did we let her not learn, that she might have had more wit? Shall we upbraid women with folly, when it is only the error of this inhuman custom that hindered them being wiser?

The capacities of women are supposed to be greater and their senses quicker than those of men; what they might be capable of being bred to is plain from some instances of females wit, which this age is not without; which upbraids us the injustice, and looks as if we denied women the advantage of education for fear they should **vie** with the men in their improvements.

To remove this objection, and that women might have at least a needful opportunity of education in all sorts of useful learning, I propose the draft of an academy for that purpose.

The academy I propose should differ but little from the public schools, where in such ladies as were wiling to study should have all advantages of learning suitable to their genius...

The persons who enter should be taught all sorts of breeding suitable to both their genius and their quality, and in particular music and dancing, which it would be cruelty to bar the sex of, because they are their darlings; but besides this; they should be taught languages and particularly French and Italians; and I would venture the injury of giving a woman more tongues than one.

They should, as a particular study, be taught all the graces of speech and all the necessary air of conversation, which our common education is so defective in that I need not expose it.They should be brought to read books ,and especially history, and so to read as to make them understand the world, and be able to know and judge of things when they hear of them.

To such whose genius would lead them to iti would deny no sort of learning; but the chief thing in general is cultivate the understanding of the sex ,that they may be capable of all sorts of conversation; that their parts and judgements being improved, they may be as profitable in their conversation as they are pleasant.

Women, in my observation, have little or no difference in them, but as they are not distinguished by education. Tempers indeed in some degree influence them, but the main distinguishing part is their breeding.

The whole sex are generally quick and sharp. I believe I may be allowed to say generally so, for you rarely see them lumpish and heavy when they are children as, boys will often be. If a woman be well-bred and taught the proper management of her natural wit; she proves generally very sensible and **retentive**; and without partiality, a woman of sense and manners is the finest and most delicate part of God's creation; the glory of her maker, and the great instance of his singular regard to man, his darling creature, to whom he gave the best gift either god could bestow or man receive .And it is the sordidest piece of folly and ingratitude in the world to withhold from sex the due lustre which the advantages of education gives to the natural beauty of their minds.

A woman well-bred and well taught, furnished with the additional accomplishments of knowledge and behaviour, is a creature without comparison; her society is the **emblem of sublime employments**; her person is angelic and her conversation heavenly; she is all softness and sweetness, peace, love, wit and delight. She is every way suitable to sublime wish, and the man that has such a one to his portion has nothing to do but to rejoice in her and be thankful.

On the other hand, suppose her to be the very same woman, and rob her of the benefit of education, and it follows thus:
If her temper be good, want of
education makes her soft and easy
Her wit, for want of teaching, makes
her impertinent and talkative
Her knowledge, for want of judgement and
experience, makes her fanciful and whimsical.
If she be passionate, want of manners
makes her termagant and cold,
which is much at one with lunatic
If her temper be bad, want of breeding makes
her worse, and she grows haughty, insolent and
loud.

If she be proud, want of discretion (which still is breeding) makes her conceited, fantastic and ridiculous. And from these she **degenerates** to be turbulent, clamorous, noisy and the devil. Methinks man kind for their own sakes since, say what we will of the women, we all think fit one time or other to be concerned with them, should take some care to breed them up to be suitable and serviceable, if they expected no such thing as delight from them .Bless up; what care do we take to breed up a good horse and to break him well, and what value do we put upon him.

When it is done, and all because he should be fit for our use; and why not a woman? Since all her ornaments and beauty without suitable behaviour is a cheat in nature, like the false tradesman who puts the best of his goods uppermost that the buyer may think the rest are of the same goodness.

But to come closer to the business, the great distinguish difference which is seen in the world between men and women is in their education, and this is manifested by comparing it with the difference between one man or woman and other.

And herein it is that I take upon me to make such a bold assertion that all the world are mistaken in their practice about women; for I cannot think that God Almighty ever made them so delightful to mankind, with souls capable of the same accomplishments with men, all to be only stewards of our houses, cooks and slaves.

I remember a passage which I heard from a very fine woman; she had wit and capacity enough, an extraordinary shape and face, and great fortune, but had been **cloistered** up all her time, and for fear being stolen, had the liberty of being taught the common necessary knowledge of women's affairs and when she came to converse in the world, her natural wit made her sensible of the want of education, that she gave this short reflection on herself: "I am ashamed to talk with my very maids," says she, "for don't know when they do right or wrong. I had more need to go to school than be married."

I need not enlarge on the loss the defect of education is to the sex, nor argue the benefit of the contrary practise; it is a thing will be more easily granted than remedied. This chapter is but an essay at the thing, and I refer the practice to those happy days, if ever they shall be, when men shall be wise enough to mend it.

THE TEACHERS

MOYA MARTIN GEORGE ZAPWE,
KING'S COLLEGE, BUDO

NAKANWAGI JACKIE,
OUR LADY OF GOOD COUNSEL SSS, GAYAZA

Questions

(a)Give the passage a suitable title.

(b)What is the meaning of the following statements as used in the passage:
i. The soul is placed in the body like a rough diamond, and must be polished or the lustre of it will never appear
ii. A woman well-bred and well taught furnished with the additional accomplishments of knowledge and behaviour is a creature without comparison.)

(c) Using about 100 words summarize the reasons the writer forwards for the need for education of women.

(d)Give the meaning of the words and phrases in bold type as used in the passage:

i. Barbarous customs
ii. Impertinence
iii. Conversible
iv. Manifest
v. Forfeit the privilege
vi. Vie
vii. Retentive
viii. Emblem of sublime employments
ix. Degenerates
x. Cloistered

Answers and more practice questions next Friday

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