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SENIOR FOUR

553/1

BIOLOGY PAPER 1

EXAM 10 MARKING GUIDE

2 HOURS 30 MINUTES

Instructions to candidates:

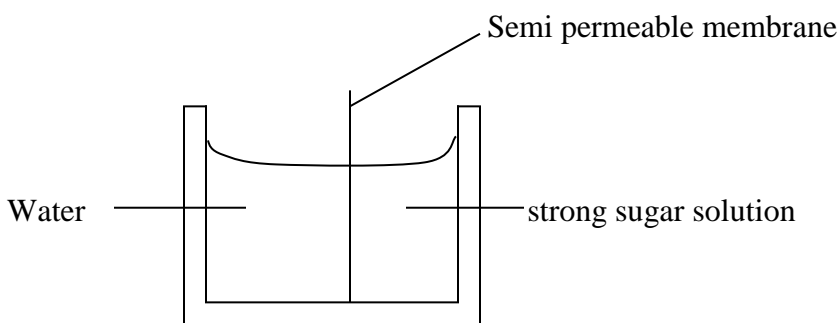
- This paper consists of three questions.
- Answer all questions in sections A and B plus two questions from section C
- Section A circle the correct alternative, answers to section B in the spaces provided and answers to section C in the answer booklets provided.

For Examiner's use only		
SECTION	Marks	Examiner's signature
A		
B	No 31	
	No 32	
	No 33	
C	No	
	No	
TOTAL		

SECTION A: (30 MARKS)

Answer all questions in this section. Write the letter representing the most correct answer to each question in the box provided.

1. Nitrogen compounds are continually being absorbed from the soil. Which one of the following would enable the plant to receive a sufficient supply of nitrogen?
A: introducing denitrifying bacteria in the soil
B: adding ammonium sulphate to the soil
C: keeping the ground well watered
D: raising the same crop each year
2. Chlorophyll is removed from leaves before they are tested for starch because
A: otherwise the iodine would not react
B: boiling in water kills the leaf
C: this helps the alcohol to penetrate the leaf
D: colour changes would not be seen easily
3. In a certain food web, toads feed on insects while insects feed on green plants. At the same time, hawks feed on green plants. At the same time, hawks feed on the toads. We can therefore conclude that toads are
A: primary consumers
B: primary producers
C: secondary consumers
D: tertiary consumers
The insects on which toads feed are primary consumer
4. An individual was found to experience prolonged bleeding after having an injury. Which one of the following vitamins is likely to be lacking in that individual?
A: vitamin D
B: Vitamin B
C: Vitamin K
D: Vitamin B₁₂
5. An experiment is set up as shown below



Which one of the following observations will be made after sometime?

- A: water will be found to contain some sugar **B: the level of water will increase**
C: the level of sugar will decrease **D: the sugar solution will become dilute**

Water will enter the sugar solution by osmosis

- Chrysalis is a quiescent insect pupa

15. Which of the following characterizes the blood in the renal vein?

- A: high in CO₂ and high in urea B: low in CO₂ and low in urea
C: high in CO₂ and low in urea D: low in CO₂ and high in urea

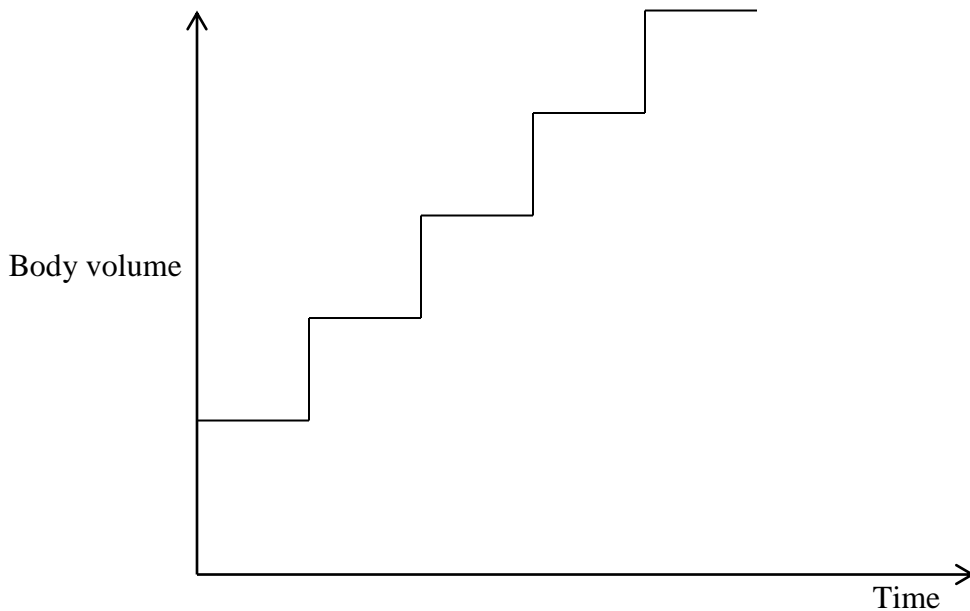
Urea is removed by the kidney before blood returns to the heart through renal vein

16. The response by which tendrils curl around and cling to stems and other objects is an example of

- A: thigmotropism B: photoperiodism
C: phototropism D: chemotropism

Thigmotropism is a **directional growth movement which occurs as a mechanosensory response to a touch stimulus**. Thigmotropism is typically found in twining plants and tendrils

17. Which one of the organisms below has a growth curve represented by the graph below?



- A: bacterium **B: insect** C: human being D: bony fish

18. In most living organisms, the respiratory gases enter and leave the body of the organisms through the same passage except in

- A: man **B: fish** C: insect D: flowering plants

Water with high oxygen content enters the mouth flow over the gills and exit through the operculum.

19. When setting up an experiment to show that energy is released by germinating seeds, the seeds are first soaked in sodium hypochlorite in order to

- A: provide proper pH for germination
B: provide nutrients for germination
C: kill fungal spores that can release energy

D: absorb carbon dioxide that interferes with the experiment.

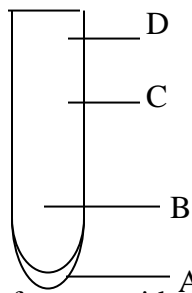
20. Gas exchange does not take place in

- A: Alveoli B: Bronchioles C: Tracheoles D: Gill filaments

21. Joan accidentally stepped on a snake and was frightened. Which one of the following is least likely to have happened immediately though it might happen later?

- A: decreased heart beat B: constriction of skin blood capillaries
C: increased output of blood from ventricles D: increased breathing rate

22. The figure below shows the setup of an experiment to determine the region of most growth in the plant root



The region of most rapid growth is marked

- A B C D

C is a region of cell elongation

23. Which of the following describes characteristics shown by vegetatively produced offspring of a flowering plant?

- A: wide variation in shape and type B: resistance to diseases
C: show early and rapid growth D: do not produce flowers

24. The following are results obtained from an experiment

Mass of dish = 50g

Mass of dish and dry soil = 200g

Mass of dish and soil after heating to red hot and cooled = 170g

Which one of the following represents the percentage of humus in the soil sample?

- A: 15% B: 25% C: 75% D 20%

Mass of dry soil = 200 – 50 = 150g

Mass of soil without humus = 170 – 50 = 120g

Mass of humus = 150 – 120 = 30g

Percentage of humus = $\frac{30 \times 100}{150} = 20\%$

25. In the test for non-reducing sugars, sodium bicarbonate is used to

- A: Act as an oxidizing agent B: Neutralize the excess acid
C: Act as a reducing agent D: Breakdown complex sugars into simple sugars

26. Which one of the blood groups will not agglutinate with any blood serum when mixed?

- A: O B: A C: AB D: B

27. Birds that ride on the back of rhinos and eat bugs they spot in dung have a relationship with the rhino that is best described as
 A: symbiosis **B: commensalism** C: parasitism D: saprophytism
 The bird benefits while rhino does not gain or loss any thing
28. According to Darwin, evolution occurs
 A: by chance **B: because of natural selection**
 C: by adaptation D: rapidly
29. Which of the following sets of characteristics comprise of only characteristics of discontinuous variation?
 A: Tongue rolling, blood groups, sex B: height, body weight, intelligence
 C: colour blindness, skin colour D: skin colour, height, albinism
30. To which one of the following bones is the biceps muscle attached by tendons?
 A: scapula and radius **B: humerus and radius**
 C: scapula and ulna D: humerus and ulna

SECTION B: 40 MARKS)

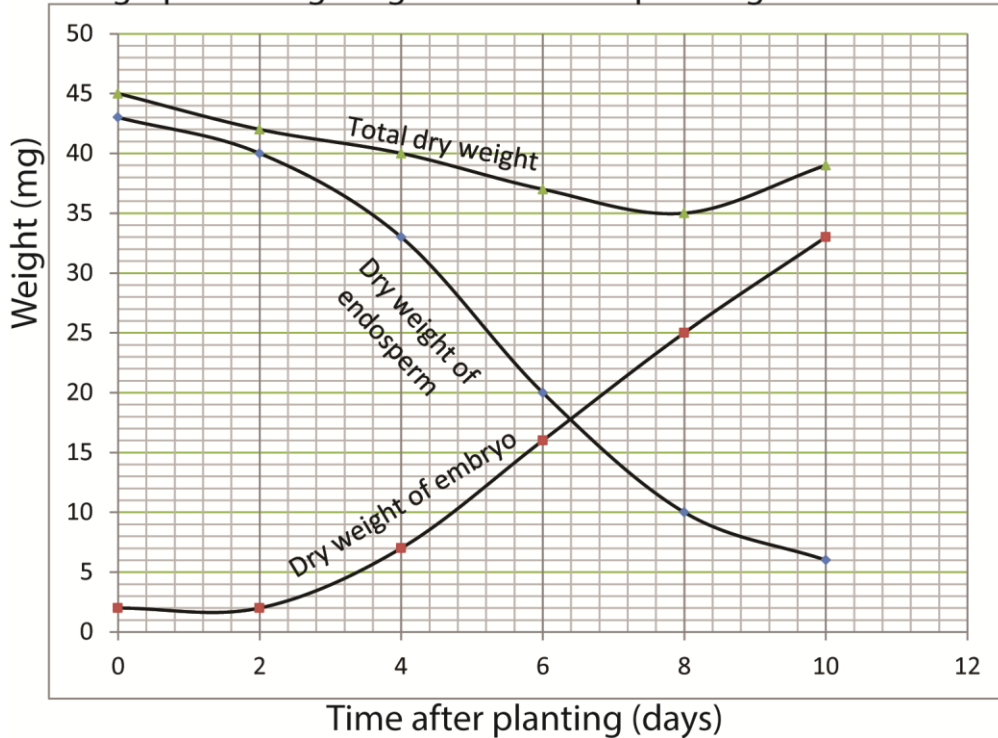
Answer all questions in this section. Answers must be written in the spaces provided.

31. During the germination and growth of a cereal, the dry weight of the endosperm, the weight of the embryo and the total dry weight were determined at two-day intervals. The results are as shown in the table below

Time after planting (days)	Dry weight of endosperm (mg)	Dry weight of embryo (mg)	Total dry weight (mg)
0	43	2	45
2	40	2	42
4	33	7	40
6	20	16	37
8	10	25	35
10	6	33	39

- (a) Complete the table above by filling in the weight of embryo on day 8 and day 10. (1 mark)
 (b) On the same axes, plot a suitable graph to show the above information (11 ½ marks)

A graph of weight against time after planting



- (c) What was the total dry weight on day 5? (½ mark)
- (d) Explain the changes in dry weight of endosperm, weight of embryo and total dry weight with time.

- (i) Dry weight of endosperm (2 marks)

Dry weight of endosperm decreases because the stored food is translocated to the growing embryo and the rest respired.

- (ii) Weight of embryo (3 marks)

Weight of embryo increases due to sugars translocated from the endosperm and later sugars from photosynthesis.

- (iii) Total dry weight (3 marks)

The initial decrease in the total dry mass is due to the aerobic respiration occurring. This consumes sugar in both the embryo and endosperm. Later, the total dry mass increases as the first foliage leaf emerges and starts to photosynthesize. The carbohydrate formed more than compensates for the respiration losses so that there is a net increase in total dry mass.

32. A normal couple produced twins when one of the twins is an Albino.

- (a) Explain why (i) Parents with normal skin colour produced an Albino. (3 marks)

Parents with normal skin that produce albino are carriers of a recessive allele i.e. their genotype Aa (A – for normal skin, recessive gene for albino)

(ii) Only one of the twins from the same pregnancy was an Albino. (2 marks)

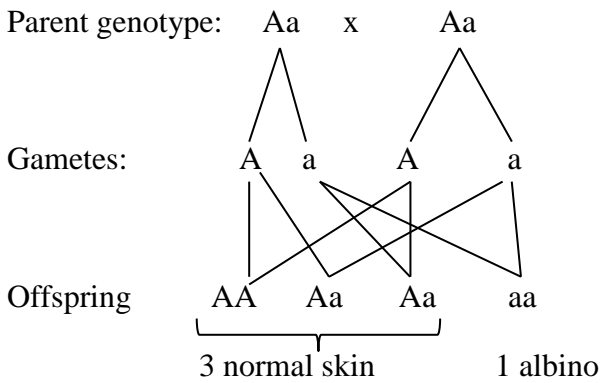
When only one of the twins is albino, it means that the female produced two eggs that were fertilized separately

(b) Using suitable symbols, carry out a genetic cross to illustrate the difference in skin colour of the twins (5 marks)

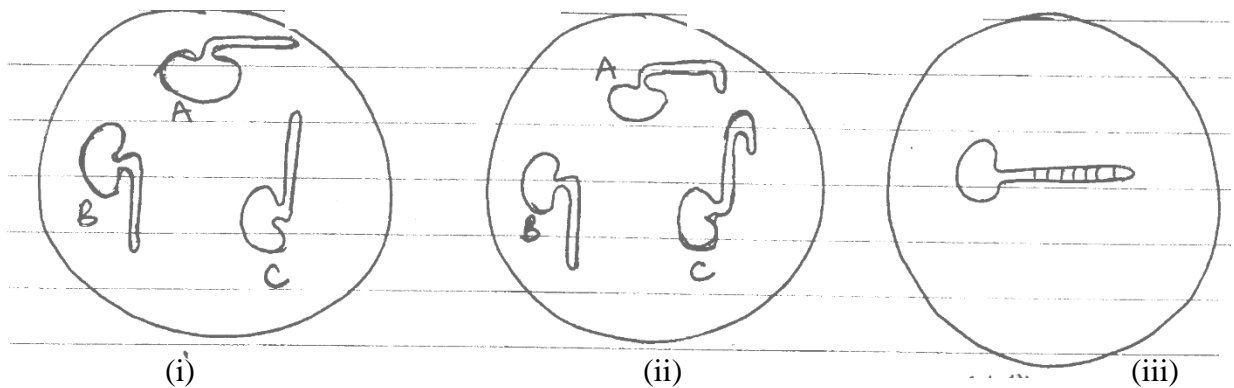
A- Allele for normal skin

a – allele for albino

Parent phenotype normal skin x normal skin



33. Three germinating beans with straight radicles were placed in a petri dish containing moist cotton wool as shown in (i) below. The dish was kept in a vertical position for 2 days in the dark. The appearance of the beans after 2 days is shown in (ii) below.



- (a) State the change that was observed in all the three radicles. (1 mark)

The radicles in seedling A and C grew and bent downwards while that of B continued to grow straight downwards

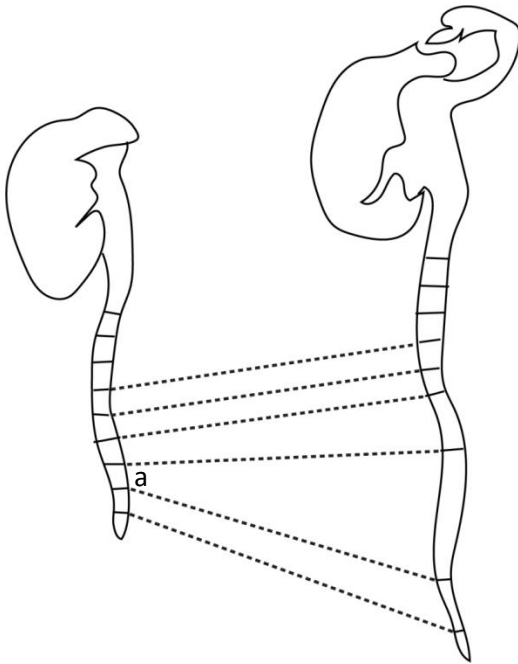
- (b) Explain the observed change in (a) above (2 ½ marks)

The seedling behaves as shown because they have positive geotropism

- (c) Petri dish (iii) was put in a clinostat which kept rotating. Explain the expected results after two days. (2 marks)

It will continue to grow horizontally because there is uniform distribution of auxins

- (d) The seedling in petri dish (iii) had equally spaced marks in Indian ink along its length at the beginning of the experiment. Draw a diagram to show the appearance of the marks after two days. (1 ½ marks)



- (e) Explain this appearance. (3 marks)

Cells do not grow equally, cells in region a called cell elongation zone elongate faster than others

SECTION C: (30 MARKS)

Answer two questions from this section.

Answers are to be written in the answer booklets provided.

34. (a) Explain the mechanism involved and the pathway taken by oxygen from the atmosphere to the liver cells in human beings. (8 marks)

In human gaseous exchange between blood and the air occurs in the alveoli. Ventilation of the alveoli occurs as follows

Inspiration.

Air is drawn into the lungs via the **trachea** and bronchi.

1. External intercostal muscles contract and rise the ribs upwards and outwards.
2. The radial and circular muscles of the diaphragm contract and diaphragm flattens.
3. There is an increase in volume of the thoracic cavity and a decrease in pressure in the lungs.
4. Air is drawn into the lungs to equalize the pressure to atmospheric pressure.

Expiration.

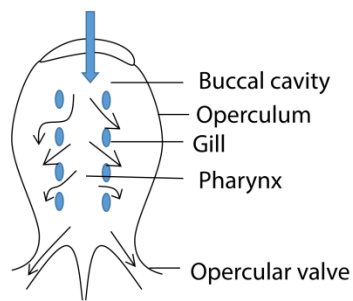
- This is a reverse of the inspiration process; air being expelled from lungs.
- It is mainly a passive process resulting from elastic recoil of the tissues that have been stretched during inspiration.
- However, in forced breathing or when breathing tubes are blocked, expiration is aided by contraction of the internal intercostal muscles and **abdominal muscles**.
- Contraction of the latter raises the pressure in the abdominal cavity, forcing the diaphragm upwards.

During inspiration enters the nose through the trachea, bronchi, and bronchioles to the alveoli from the alveoli blood carry oxygenated blood through the pulmonary vein to left atrium. From the left atrium blood is pumped to the left ventricle, to Aorta, and hepatic artery to the liver

- (b) Describe how inspiration occurs in bony fish. (7 marks)

Inspiration in fish

Water is sucked through the mouth by expansion of buccal cavity and then into the opercula cavity by outward movement of the operculum accompanied by contraction of the buccal cavity



35. (a) What is parasitism? (1 mark)

Parasitism is a **relationship between two species of plants or animals in which one lives in or on another organism benefits at the expense of the other, usually without killing the host organism.**

(b) Give four effects of ecto-parasites on their hosts (4 marks)

- Ectoparasites such as ticks and lice can cause **anaemia,**
- **weaken the host by sucking nutrients, blood and proteins from the host causing weight loss**
- transmit disease causing organisms for example ticks transmit **Tick-Borne Relapsing fever**
- damage the skin causing wounds and secondary infections
- cause intensive itching leading to discomfort
- Loss of hair

(c) Describe how schistosoma mansoni is adapted to the parasitic mode of life. (10 marks)

- has **cilia or tails for swimming to find the host**
- **has secretory glands for host penetration,**
- **has a tegument and glycocalyx for parasite protection/host immuno-modulation,**
- has secondary host for transmission
- a gynaecophoric canal for sustained pairing between sexes for easy reproduction
- Production a large number of eggs to increase the chances of survival

36. (a) Describe the process of fertilization in human beings. (5 marks)

Fertilization **occurs when a sperm fuses with Ovum; during intercourse sperms are released from the testis through the urethra into the vagina.** The sperm travels through the fallopian tube and penetrates the zona pellucida layer of the ovum (female egg) and fuses with it which forms zygote (fertilized egg).

(b) Explain how pregnancy is sustained until parturition. (10 marks)

In the events of pregnancy

Implantation

Following fertilisation, the zygote divides (cleavage) mitotically until a hollow ball of cells, the **blastocyst** is produced. It takes three days to reach the uterus and a further three or four days to

become implanted in the lining of the uterus. The outer layer of the blastocyst, called the **trophoblast**, develops into embryonic membranes, the **chorion** and **amnion**.

The chorion develops villi which grow into the surrounding uterine tissue from which they absorb nutrients. These will form part of the **placenta** which is connected to the foetus by the umbilical cord.

The amnion develops as a membrane around the foetus and encloses the amniotic fluids, a watery liquid which protects the foetus by cushioning it from physical damage.

The corpus luteum persists due to the secretion of a hormone called **Human Chorionic Gonadotropin (HCG)** by the placenta. This hormone signals to the mother's body that an embryo is present in the uterus.

The corpus luteum continues to secrete progesterone which coupled with small but steady secretion of oestrogen, maintain the continued development of the uterus and prevents menstruation.

After the first three or four months of pregnancy, the corpus luteum begins to regress and the job of secreting oestrogen and progesterone is taken over by the placenta.

In this way, the endometrium is maintained in a suitable state throughout pregnancy.

The hormonal control of birth

Towards the end of pregnancy, the levels of oestrogen in blood rise while that of progesterone falls. It has been suggested that this plays some part in bringing about birth. Indeed, oestrogen promotes uterine contraction whereas progesterone doesn't.

But the most direct cause of birth is another hormone, **oxytocin** secreted by the posterior lobe of the pituitary gland that causes uterine muscle contraction.

Oestrogen and progesterone are also responsible for the growth of the mammary gland in preparation for milk production (lactation). After birth, milk flow is initiated by a hormone called **prolactin** secreted by the anterior lobe of the pituitary gland.

37. Describe how the various parts of the human digestive system are adapted to their functions.

(15 marks)

Adaptations of the mouth for digestion

- Contains space to **receive food by ingestion**,
- **contains teeth to break food into small particles by mastication**
- **contains saliva** to soften and lubricate food for swallowing
- **Saliva** contains ptyalin for digestion of starch

Adaptation of esophagus

It is hollow muscular tube to allow passage of food

Adaptations of the stomach to digestion

- Has muscular walls for pounding food and mix it with digestive juices
- Produces **Hydrochloric acid** that kills germs and provide pH for the action of pepsin
- Produces an enzyme **pepsin** which breaks down proteins into short polypeptide chains. Pepsin is secreted as an inactive precursor **pepsinogen** to prevent the gastric gland being destroyed by its own enzyme (auto-digestion).
- Produces an enzyme **renin** coagulates casein, the soluble protein of milk, forming insoluble curd which is then attacked by pepsin.
- Dilated to provide temporary store of food

Adaptation of the duodenum

- Receives bile from the liver for emulsification of fats
- Received the following enzymes from the pancreas
 - (i) Pancreatic amylase: breaks down starch to disaccharide maltose.
 - (ii) Pancreatic lipase: breaks down tri-glycerides in the emulsified fat into mono-glyceride and fatty acids.
 - (iii) Protease **and nucleases for digestion of proteins and nucleic acids** into nucleotides
 - (iv) **Bicarbonate** neutralise acidic chime from the stomach

Adaptations of ileum to digestion

Produces various enzymes for final digestion

- **Maltase**: hydrolyses maltose to glucose, thus completing digestion of starch.
- **Sucrase** hydrolyses sucrose (Sugar cane) to glucose & fructose.
- **Lactase** hydrolyses lactose (Milk sugar) to glucose & galactose.
- **Nucleotidases** split nucleosides into constituent subunits.
- Peptidases breakdown dipeptides and tripeptides into amino acids

Adaptations of ileum for absorption

- Long to allow food enough time for absorption

- Villi and microvilli increase surface area for absorption
- Well supplied by blood to carry away absorbed food so as to maintain diffusion gradient
- The villi have thin membrane to reduce diffusion gradient
- Villi have high concentration of mitochondria to provide energy for active transport.
- **circular fold** increase surface area for absorption

Adaptations of colon for absorption of water

Long with slow peristaltic movements

END