P530/1 BIOLOGY PAPER 1

MARKING GUIDE

SECTION A (40 MARKS)

1. Which one of the following organisms illustrates that not all active animals require that the circulatory system transport gases?

A. mammals
B. insects
C. fish
D. birds

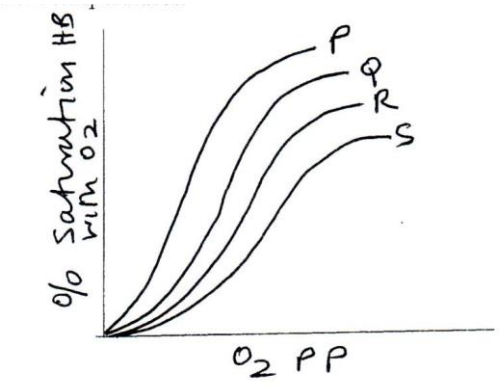
B

2. Which one of the features below is common to both the digestive and respiratory tracts in humans?

A. gullet
B. external nares
C. epiglottis
D. diaphragm

C

3. Figure 1 shows haemoglobin oxygen dissociation curves of an animal at different temperatures.



Which of the curves represents the oxygen dissociation curve at the least temperature?

A. Q
B. P
C. R
D. S

B

4. One advantage of excretion of urea over uric acid excretion is that, urea……..

A. requires less energy to form
B. can be concentrated to a greater extent
C. is not a toxic substance.
D. requires less water to excrete

A

5. Which of the following mechanisms is employed by fresh water Osteichthyes in maintaining water balance? By…….

A. excreting salt across their gills
B. periodically drinking small amounts of water
C. excreting hypotonic urine
D. excreting wastes in the form of uric acid

B

6. Excretion of a hypotonic urine in humans is mainly associated with the

A. Bowman's capsule
B. the proximal convoluted tubule
C. the loop of Henle
D. the distal convoluted tubule

D

7. Which of the following will result in air entering into the human lungs?

A. Atmospheric pressure is less than pressure inside the lungs
B. Atmospheric pressure is greater than pressure inside the lungs
C. Although the pressure is the same inside and outside the lungs the partial pressure of oxygen is lower within the lungs
D. The residual air in the lungs causes the partial pressure of oxygen to be less than outside

B

8. In humans the following apply to the respiratory centre except that, it

A. is stimulated by carbon dioxide
B. is located in the medulla oblongata
C. controls the rate of breathing
D. controls the rate of respiration

D

9. Carbon dioxide is carried in the plasma in form of

A. carboxy haemoglobin
B. bicarbonate
C. carbamino haemoglobin
D. combined with carbonic anhydrase

C

10. Which of the animals below breathes by positive pressure mechanism?

A. Fish
B. Humans
C. Birds
D. Frogs

D

11. Which of these is a true statement as regards to carbon dioxide transport by blood?

A. In lung capillaries carbon dioxide combines with water to give carbonic acid
B. In tissue capillaries carbonic acid breaks down to carbon dioxide and water
C. In lung capillaries carbonic acid breaks down to carbon dioxide and water
D. In tissue capillaries carbonic acid combines with hydrogen ions to form the carbonate ions

C

12. During blood typing agglutination indicates that the

A. plasma contains certain antibodies
B. red blood cells carry certain antigens
C. plasma contains certain antigens
D. red blood cells contain certain antibodies

A

13. The cross carried out to find the genotype of an organism is known as

A. Back cross
B. Breeding true
C. Test cross
D. Reciprocal cross

C

14. The counter current flow in bony fish achieves a high level of gas exchange because it……

A. Increases the concentration gradient.
B. Decreases the distance across which gases diffuse.
C. It increases the speed at which water flows over the gills.
D. Maintains a high concentration gradient.

D

15. Which of these does **not** pertain to B cells?

A. Have passed through the thymus
B. Specific receptors
C. Antibody mediated immunity
D. Synthesize and liberate antibodies

A

16. Which of the following correctly defines plasma cells?

A. They are the same as memory cells
B. They are formed from plasma cells
C. Are B cells that actively secrete antibodies
D. Are inactive T cells carried in the plasma

C

17. Which of the following couples is likely to give birth to a baby suffering from foetal erythroblastosis?

A. Rh^+ mother and Rh^- father
B. Rh^- mother and Rh^- father
C. Rh^+ mother and Rh^+ father
D. Rh^- mother and Rh^+ father

D

18. Which one of the following comes before the others during the process allopatric speciation?

A. Geographical isolation
B. Pre mating isolating mechanism
C. Post mating isolating mechanism
D. Character displacement

A

19. During the evolution of the horse, limb length gradually increased. This is an example of

A. disruptive selection
B. stabilizing selection
C. directional selection
D. transient polymorphism

C

20. What is the role of the hormone cholecystokinin in digestion? It……..

A. Inhibits the secretion of hydrochloric acid in the stomach wall.
B. Stimulates the pancreas to secrete digestive enzymes.
C. Stimulates the liver to release bile juice.
D. Induces the pancreas to release hydrogen carbonates ions.

B

21. If **A** represents assimilation, **R** respiration and **P** net production, then the net production of photosynthesis can be arithmetically expressed as;

A. A = R + P.
B. A + P = R.
C. A + R = P.
D. A – R = P.

D

22. Which of the plants below is the last type to appear in the ecological succession of a forest?

A. mosses
B. trees
C. grasses
D. shrubs

B

23. Which of the following is **not** true about parenchyma cells?

A. They are lignified.
B. Are linked to one another by means of plasmodesmata through pits in walls.
C. Some of them are photosynthetic.
D. They act as storage sites.

A

24. Which of the following processes does not require energy?
    A. Absorption of glucose from the gut,
    B. Reabsorption of glucose from the glomerular filtrate.
    C. Absorption of mineral salts by plant roots.
    D. Absorption of water by plant roots.

D

25. Which of the following is a characteristic of a rapidly growing population?
    A. There are equal proportions of all age groups.
    B. There is more of the reproductive age group.
    C. There is more of the pre-reproductive age group.
    D. Birth rate balances mortality rate.

C

26. Allergy causing antigens cause activated mast cells to release which of the following substances
    A. insulin
    B. antihistamines
    C. antibiotics
    D. histamines

D

27. A type of self-regulation such as the relationship between the pituitary gland, thyroid stimulating hormone, the thyroid gland and thyroxin is known as
    A. cyclosis
    B. negative feed back
    C. synopsis
    D. voluntary control

B

28. Given that 4% of the members of a population of pea plants are short (a recessive character), what is the frequency of both the recessive allele and dominant allele respectively?
    A. 0.2 and 0.8
    B. 0.8 and 0.2
    C. 0.04 and 0.64
    D. 0.04 and 0.32

A

29. Which of the following body structures originates from the mesoderm in the embryo?
    A. Liver
    B. Muscles
    C. Nerves
    D. Epidermis

B

30. During inhalation, the contraction of the diaphragm and intercostal muscles causes the thoracic cavity's volume to
    A. decrease and pressure to increase
    B. increase and pressure to decrease
    C. increase and pressure to increase
    D. decrease and pressure to decrease

B

31. Which of these correctly describes the distribution of ions on either side of an axon when it is not conducting a nerve impulse?
    A. Na^+ outside and K^+ inside
    B. K^+ outside and Na^+ inside
    C. Charged protein outside, Na + and K^+ inside
    D. Na^+ and K+ outside and water only inside

A

32. Hormonelike substances that are secreted by all types of cells and are involved in the sensation of pain are called
    A. prostaglandins
    B. adrenalins
    C. thyroxin
    D. insulin

A

33. Which of the following pairs of structures below represent analogous structures?
    A. whale's flippers and bat's wings
    B. bird's wings and a butterfly's wings
    C. hawk's wings and robin's wing's
    D. dog's legs and a horse's leg

B

34. Sexual reproduction can speed up evolution because it provides more
    A. chromosomes
    B. genetic variation
    C. identical cells
    D. organelles

B

35. Organisms that require a constant supply of oxygen to live are called
    A. obligate anaerobes
    B. facultative anaerobes
    C. chemotropic autotrophs
    D. obligate aerobes

D

36. Which of the following is needed for new species to form?
    A. A niche
    B. Homologous structures
    C. Analogous structures
    D. Reproductive isolation

D

37. Scientists are able to change the gene pool of a population by carrying out
    A. adaptive radiation
    B. natural selection
    C. artificial selection
    D. convergent evolution

C

38. Which of these terms has the same meaning as natural selection?
    A. adaptive radiation
    B. convergent evolution
    C. survival of the fittest
    D. divergent evolution

C

39. In humans the placenta develops from the chorion. This indicates that human development
    A. resembles that of the chick
    B. is dependent upon extra embryonic membranes
    C. cannot be compared to lower animals

A

D. only begins upon implantation

40. Which of the following best describes the term imprinting?

A. Learning that occurs during a critical period in young animals
B. Learning that requires a sign stimulus to trigger its start
C. Innate behaviour that requires practice to perfect
D. Innate behaviour that does not require practice to perfect

D

SECTION B (60 MARKS)

41. (a) (i) Define the term attenuated microorganism? (01 mark)

These are pathogens that have been made harmless; but slightly still in possession of their immunogenic property;

ii) Vaccines protect against disease by stimulating the production of memory cells. Describe how memory cells are produced and protect the body from disease. (05 marks)

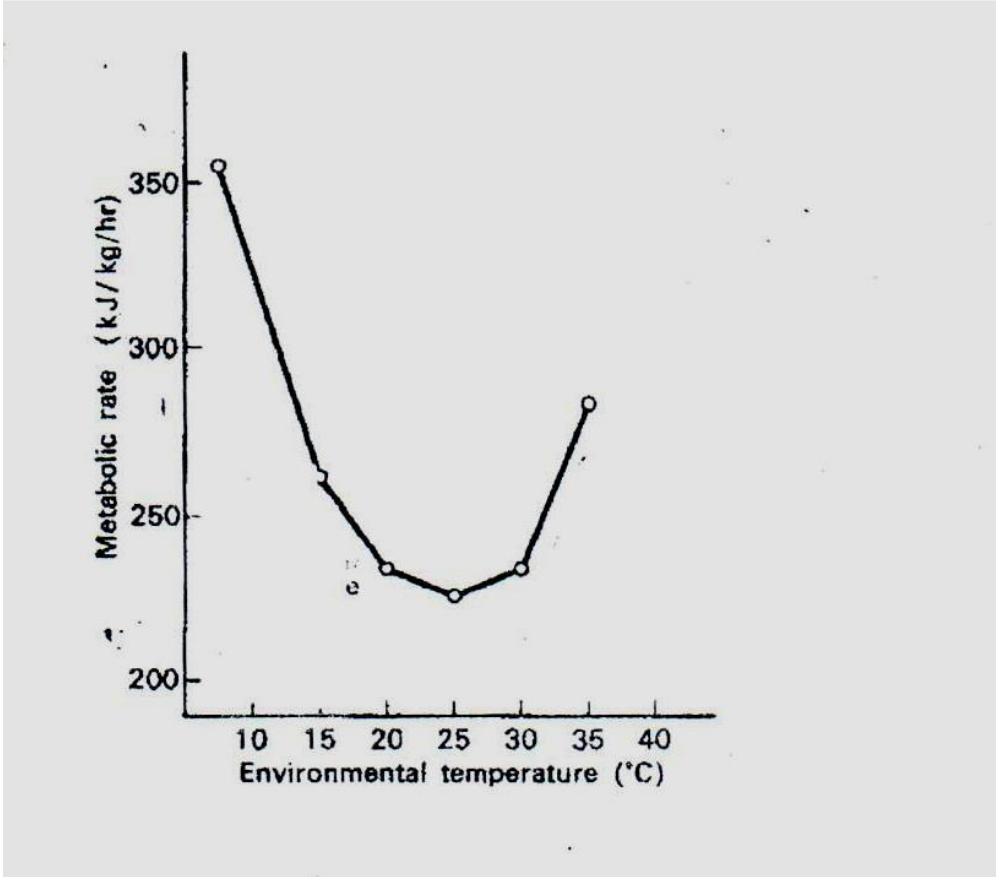
Memory cells are produced as a result of the B cells; trying to recognise a particular antigen; and producing antibodies that bind to it; the surface membrane of the B cells contains antigen receptors; whose specific shape is identical to the antibodies; which that cell can make; as the cell binds to the antigen, it is activated to clone itself; forming many identical copies of itself. This action occurs in the presence of lymphokines secreted by helper T cells and antigens as well; the memory cells survive for long periods of time; and protect the body by enabling rapid response be made to any future infection; they always stay in a ready-mode to quickly recognise and attack any returning bacteria and/or virus;

(b) The table shows statements, which may be related to active immunity or passive immunity. Complete the table by placing a tick in the box if the statement is true or a cross in the box if the statement is false. (04 marks)

Statement	**Active immunity**	**Passive immunity**
Antibodies produced if the body is re-infected by the same pathogen.	√;	X;
Antibodies developed in horse injected into human.	X;	√;
Antibodies received in breast milk.	X;	√;
Attenuated microorganisms used in the vaccine.	√;	X;

½ mark each

42. Figure 2 shows the metabolic rate of a resting dog at different environmental temperatures



(a) Describe the effect of increasing environmental temperature on metabolic rate (04 marks)

At low temperatures, from 10°C to 15°C the rate of metabolism falls drastically from 350 - 260/KJ/Kg/hr; and continues to fall gradually from 260 – 180 KJ/Kg/hr; when temperature was increased from 15°C to 25°C; as environmental temperature rose from 25°C to 35°C; there was a steep increase; in the metabolic rate of the dog from 180 – 280KJ/Kg/hr;

(b) Explain the change in metabolic rate between

(i) 20^0C and 30^0C (02 marks)

Between 20°C to 25°C the metabolic rate is still low; because the enzymes controlling it are not yet fully activated; but as it rises from 25°C to 30°C; rate of metabolism begins to shoot high; due to the activation of the enzymes controlling metabolism;

(ii) above 30^0C (02 marks)

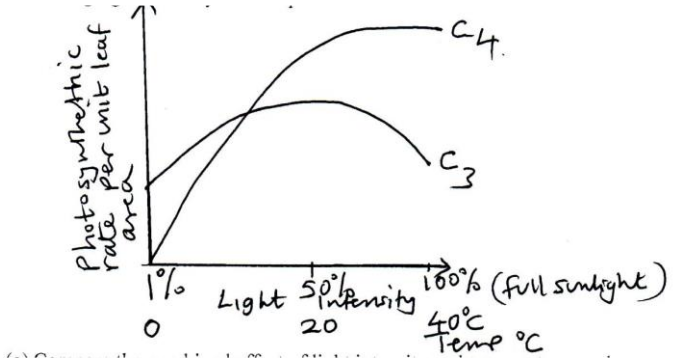
At temperature 30°C and above, the metabolic rate increases rapidly; which is attributed to the full activation of the enzymes thence operating at their peak;

(c) Explain how the Camel a desert mammal is specialized to meet the problems of overheating and water stress in its habitat (02 marks)

In case of water stress, these animals possess well specialised digestive and urinary tracts; where they lose only 1.3 litres of water. This is a mechanism for resisting water deprivation while in the desert; fluids are absorbed in the end part of the intestines where small faecal balls are formed;

In case of overheating, a fully hydrated camel may have a diurnal body temperature range of between 36 to 38°C; however, when exposed to high environmental heat load; body temperature may fluctuate by 6 to 7°C, from approximately 34 to 41°C;

43. Figure 3 shows the comparative photosynthetic response of C_3 and C_4 plants to increasing light intensity and temperature



(a) Compare the combined effect of light intensity and temperature on the photosynthetic rate (03 marks)

Increment in temperature and light intensity from 0°C and 1% to 20°C and 50% respectively; results in a rapid increase in the rate of photosynthesis per unit leaf area in both C_3 and C_4 plants; however, further increase in the temperature and light intensity from 20°C and 50% to 40°C 100% respectively; results in the decline in the rate of photosynthesis in the C_3 plants; but a further increase in photosynthetic rate in C_4 plants;

(b) State the advantage of

(i) C_4 photosynthesis over C_3 photosynthesis (03 marks)

There is improved efficiency in the fixation of carbon dioxide; due to the possession of two carbon dioxide acceptors;

These plants grow in regions of high light intensity; thence more tolerant to dry conditions;

Possession of a modified chloroplast that enable them to make use of the available light energy;

(ii) C_3 photosynthesis over C_4 photosynthesis (02 marks)

Less light energy is required for photosynthesis to occur compared to the C_4 plants;

Low temperatures are still favour the photosynthetic processes compared to C_4 plants that may require temperatures above 35^{0}C;

(c) State the likely location of (02 marks)

(i) C_3 plants

In the cooler and temperate regions;

(ii) C_4 plants

In the tropical and subtropical regions;

44. (a) Distinguish between sex linked and sex-limited characters (02marks)

Sex-linked characters/traits are those that are located; on sex chromosomes; while sex limited traits are those that are determined by genes located on autosomes; and expressed only in one sex;

(b) Work out a cross between round yellow and wrinkled green peas that gave rise to only round yellow and wrinkled yellow off spring if Round and yellow where dominant phenotypes. (08 marks)

Let Y represent allele for yellow-coloured peas;

Let y represent allele for green-coloured peas;

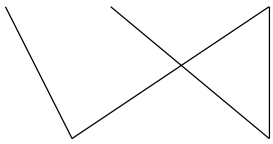
Let R represent allele for round shaped peas;

Let r represent allele for wrinkled shaped peas;

Parental phenotypes Round yellow peas X Wrinkled green peas;

Parental genotypes YYRr X rryy;

Gametes YR Yr ry;



Offspring YyRr Yyrr;

45.(a) Explain what is meant by greenhouse effect (03 marks)

This is a phenomenon that shows how radiant energy from the sun; warms the surfaces of the earth (sea and land); when the sun's energy reaches the earth's atmosphere, some of it is reflected back to space; while the rest is absorbed and re-radiated by the greenhouse gases for example carbon dioxide and water vapour; as a result, the gases of lower atmosphere are warmed up; and some of the heat escapes into space but most of it is radiated back to the earth's surface, warming the planet further;

(b) State the harmful consequences of the following

(i) Ozone layer depletion (03 marks)

It increases the amount of ultraviolet radiation that reaches the earth's surface which results into;

Increased rate of skin cancer infections;

Genetic mutation that is the ultraviolet radiation is absorbed by purines and pyrimidines in DNA;

Also causes damages to the immune system;

(ii) Discharge of smoke in air from industries (03 marks)

Increased global warming;

Increased respiratory health problems for instance lung cancer;

Greatly contributed to climate change;

Also led to formation of acid rain;

Also has led to deterioration of fields;

c) Suggest **one** way how ozone layer depletion has been minimized (01 mark)

By stopping the addition/release of ozone depleting compounds into the atmosphere for instance chlorofluorocarbons;

46.(a) What is meant by **polymorphism** (01 mark)

This is the occurrence of different forms; among the members of a population or in a life cycle of an individual organism;

(a) *Biston betularia* the peppered moth is light coloured and mottled. In 1848 a dark (melanic) mutant form was captured in Manchester. By 1895 98% of these moths in Manchester were melanic forms. The dark two forms are morphs, the normal form being *Biston betularia typica* and the dark form *Biston betularia carbonifera*

Table 1 observed frequency of the two morphs of *Biston betularia*

Habitat	**Typica**	**Carbonifera**
Rural woodland	**94.6%**	**9.4%**
Industrial woodland	**10.1%**	**89.9%**

Table 2 observed frequency of predation of *Biston betularia* by woodland birds

Habitat	**Typica**	**carbonifera**
Rural woodland	**13.6%**	**86.3%**
Industrial woodland	**74.2%**	**25.8%**

(i) Comment on the distribution of the two forms of moth as shown in Table **1** (03 marks)

In the rural woodland, the frequency of *typica* is quite high; compared to that of *carbonifera;* while in the industrial woodland, the frequency of *typica* is much lower compared to that of *carbonifera;*

(ii) How does the data in Table **2** support the idea of natural selection? (04 marks)

In the rural woodland, the *typica* species easily camouflages in the habitat; and therefore, the predation rate is quite low at 13.6% while for the *carbonifera species,* the predation rate is so high at 86.3% because being dark; it is easily exposed to the predator and therefore easily eaten; this shows that *typica* species is well adapted in rural woodland while *carbonifera* is not; In the industrial woodland, the predation rate in the *typica* species is extremely high; because it is highly exposed compared to *carbonifer*a species which camouflages well with the environment; thence well adapted to the environment; thence supporting the idea of natural selection;

(iii) Given that the data shown in Table 2 was collected in the 1950s, would you predict similar figures if the investigation was to be repeated this year (02 marks)

No, because today with advancement in technology and increased awareness on environmental degradation; there is reduced emission of pollutant gases to the environment;

END