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UACE Biology 2017 paper 1

- Which one of the following pairs of hormones when released increase the level of blood sugar in the body?
 A. Secretin and adrenaline
 B. Adrenaline and glucagon
 C. Insulin and antidiuretic hormone
 D. Secretin and thyroxine

Answer is B

- The inheritance of comb shape in fowl is controlled by two dominant alleles P and R. What is the probability of producing a homozygous double recessive fowl with no comb, from parents of genetic constitution PpRr and PpRR?
 A. 0% B. 25% C. 50% D. 100%

Answer is A

The parent with genotype PpRR lacks a recessive gene, r

- The surface area and volume of four animals A, B, C and D are given in table 1. Which one of them would experience the highest rate of heat loss when cold?

Animal	Surface area (cm ²)	Volume (cm ³)	Surface area to volume ratio (cm ⁻¹)
A	20	5	4
B.	40	80	0.5
C.	60	60	1
D.	80	100	0.8

Answer is A

Rate of heat loss is proportional to ratio of surface area to volume

- Which one of the following genetic abnormalities does not result from non-disjunction?
 A. Klinefelter's syndrome B. Turner' syndrome
 C. Haemophilia D. Down's syndrome

Answer is C

- The earth worm does not require a special respiratory organ because
 A. it is not very active metabolically
 B. its moist cuticle allows gases to dissolve and diffuse easily
 C. its surface lacks a cuticle
 D. it has large surface area to volume ratio

Answer is D

- Variation among organisms which reproduce by fission can be due to
 A. crossing over B. mutation C. random fertilization D. Independent assortment

Answer is B

Fission is asexual reproduction where crossing over, random fertilization and independent assortment do not occur.

7. Which one of the following types of plants is likely to have the most thin leaf cuticle?
A. mesophytes B. halophytes C. hydrophytes D. Xerophyte

Answer is C

Hydrophyte live in water thin cuticle allows them to lose excess water

8. The cutting of a plant apex encourages the growth of many side branches because
A. it encourages the interaction of auxins and gibberellins
B. secondary growth increases in the stem
C. auxins transfer downwards along the stem
D. apical dominance is removed

Answer is D

9. Dioecious plants are rare because
A. they separate male and female flowers on the same plant
B. there is self-incompatibility of the gametes
C. part of each species of Dioecious plant rarely mature at the same time
D. Part of each species of Dioecious plant does not bear fruits

Answer is D

In Dioecious plants male plants do not bear fruits and hence seeds

10. During protein synthesis, the anticodon base sequence on tRNA is AUG. What is the base sequence on the template DNA strand
A. UAC B. ATG C. AUG D. TAC

Answer is B

11. The figure 1 shows changes in dry mass of a growing seedling with time.

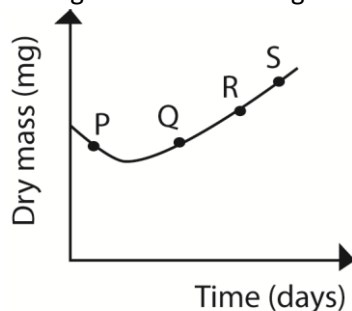


Fig. 1

Which part of the curve indicates growth where respiration is higher than photosynthesis?

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

Answer is C

12. Cones have better visual acuity than rods because cones
A. Have little retinal convergence
B. Are more sensitive to light
C. Connect with a single nerve fibre
D. Are more concentrated at the fovea

Answer is A

13. Figure 2 shows parallel flow across a gill plate in fish

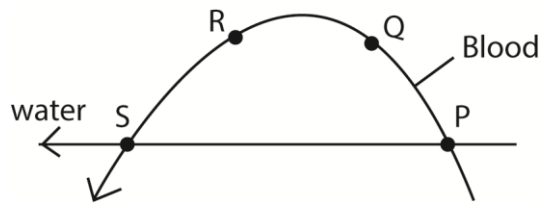


Fig. 2

Which one of the points indicated on the figure would have the highest diffusion gradient?

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

Answer is B

At P water has the highest concentration of oxygen and lowest value of carbon dioxide concentration while blood has the lowest oxygen concentration and high concentration of carbon dioxide

14. A common aspect between photosynthetic and chemosynthetic bacteria is that they both

- A. use water as source of hydrogen
B. release oxygen during the synthesis of organic compound
C. contain energy absorbing compound
D. use carbon dioxide as a raw material

Answer is D

15. A plant which is not lignified, has poorly developed xylem tissue with large air spaces in stem and leaves belongs to a group of

- A. mesophytes B. hydrophytes C. halophytes D. xerophytes

Answer is B

16. Which one of the following organisms possesses a heart which pumps out only deoxygenated blood?

- A. Birds C. mammals C. amphibians D. fish

Answer is D

17. Which one of the following cells formed by mitosis

- A. Ovum B. secondary spermatocyte
C. Primary spermatocytes D. secondary oocyte

Answer C

18. Which one of the following changes in guard cells will lead to the opening of the stomata?

- A. increase in pressure potential
B. increase in the hydrogen ion concentration
C. increase in water potential
D. reduction in sugar level

Answer is A

When a plant cell become turgid, pressure potential increases

19. Which one of the following groups comprises the organism with least common features?

- A. species B. genus C. family D. order

Answer is D

Closeness of organisms decrease from species > genus > family > order > class > phylum > kingdom

20. The purpose of immunizing an individual against a disease is to
- A. stop the disease-causing organisms from attacking the individual
 - B. enable the individual produce antigens to combat pathogens
 - C. ensure that the individuals body is strong
 - D. induce the production of antibodies to combat disease causing features

Answer D

21. Sucrose is a major transport solute in plants because it
- A. is highly soluble so can be in high concentration in the sap
 - B. Can be easily converted into glucose and fructose
 - C. Is insoluble so it cannot be used in chemical reaction
 - D. Can be oxidized by the living parts

Answer is A

22. Which one of the following is the tidal volume in an individual whose ventilation rate is 2000dm³ and takes 10 breathes per minute?
- A. 0.2dm³ B. 2.0dm³ C. 200dm³ D. 20dm³

Answer is C

$$\text{Tidal volume} = \frac{\text{ventilation rate}}{\text{number of breaths per minute}} = \frac{2000}{10} = 200\text{dm}^3$$

23. Imprinting can be described as
- A. a behaviour that involves recognising a print mark
 - B. an innate behaviour that require practice
 - C. learning that occurs at critical period in early development
 - D. learning that require a sign stimulus

Answer is C

24. The following equation summarizes aerobic respiration of glucose



If the energy released on complete oxidation of one mole is 2880kJ and one ATP contain 30.6kJ of energy; what is the percentage efficiency of aerobic respiration of glucose in the equation?

- A. 40% B. 38% C. 68.65 D. 94.1%

Answer is A

$$\begin{aligned}\text{Efficiency} &= \frac{\text{useful energy}}{\text{total energy}} \times 100\% \\ &= \frac{38 \times 30.6}{2880} \times 100\% \\ &= 40\%\end{aligned}$$

25. Which one of the following cell types provides strength with flexibility in plant tissues?
- A. Parenchyma B. collenchyma C. tracheid D. sieve tubes

Answer is B

Collenchyma cells contain thicken living walls which provide strength and flexibility

26. If a plant cell is placed in a hypertonic solution, its water potential becomes
- A. Zero B. more negative C. positive D. none

Answer B

27. Figure 3 shows the frequency of a trait among a group of students

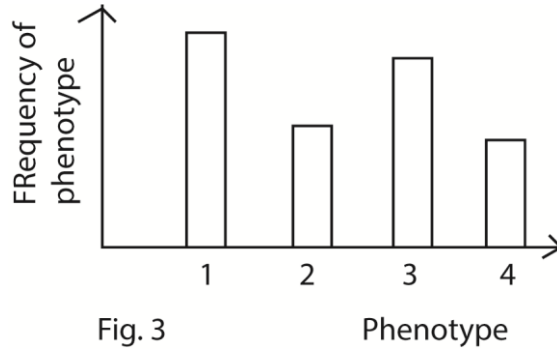


Fig. 3

Phenotype

The difference in phenotypes is due to

- A. the altitudes where individual live
- B. genotypic make up
- C. frequency of disease among individuals
- D. different diet among individuals

Answer is B

Genotypic make up cause discontinuous variation

28. A specimen observed under an electron microscope measures 50mm and actual specimen measures 5.0μm. the magnification under the microscope is

- A. 10
- B. 55
- C. 150
- D. 10×10^3

$$\text{Magnification} = \frac{\text{image size}}{\text{object size}} = \frac{50 \times 10^{-3}}{5 \times 10^{-6}} = 1 \times 10^4$$

29. Saturated fatty acids and unsaturated fatty are similar in

- A. the number of carbon to carbon bonds they possess
- B. their consistency at room temperature
- C. the number of oxygen atoms present
- D. the number of hydrogen atoms they contain

Answer is C

Each contain a carboxylic group with two oxygen atom

30. What would be the estimated fish population in a lake if 350 fish were captured, marked and released, and later 450 fish including 150 marked were captured?

- A. 116
- B. 1050
- C. 650
- D. 250

Answer is B

150 fish are contained in 450 fish

$$350 \text{ fish will be contained in } \frac{450 \times 350}{150} = 1050$$

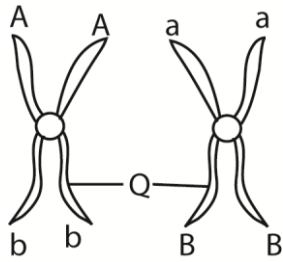
31. Which one of the following substances is not transported by the blood circulatory system in arthropod?

- A. nutrients
- B. hormones
- C. respiratory gases
- D. nitrogenous wastes

Answer is C

In arthropods oxygen and carbon dioxide are transported by tracheal system

32. Figure 4 represents a pair of homologous chromosomes during meiosis



If crossing over at point marked Q, the genotypes in gametes formed would be

- A. AA, BB B. AA, bb C. Ab, AB D. AB, ab

Answer is D

33. Promotion of cell division by cytokinins only in the presence of auxins is an interaction known as

- A. Synergistic B. antagonistic C. summative D. complementary

Answer is A

34. Which one of the following activities results into release of nitrogen into atmosphere?

- A. water logging in the soils B. overgrazing of pasture
C. growing of legumes D. uptake of mineral salts by the plant

Answer is A

35. Which one of the following is true of what occurs at excitatory synapse when an impulse arrives?

- A. Chloride ions channels close
B. Receptor sites close
C. Post synaptic membrane become impermeable to calcium ions
D. Sodium channels open

Answer is D

36. Stretching of the urinary bladder is made possible by presence of

- A. Squamous epithelium
B. Transitional epithelium
C. Columnar epithelium
D. Stratified epithelium

Answer is B

37. Figure 5 shows the rate of photosynthesis of a plant at varying conditions.

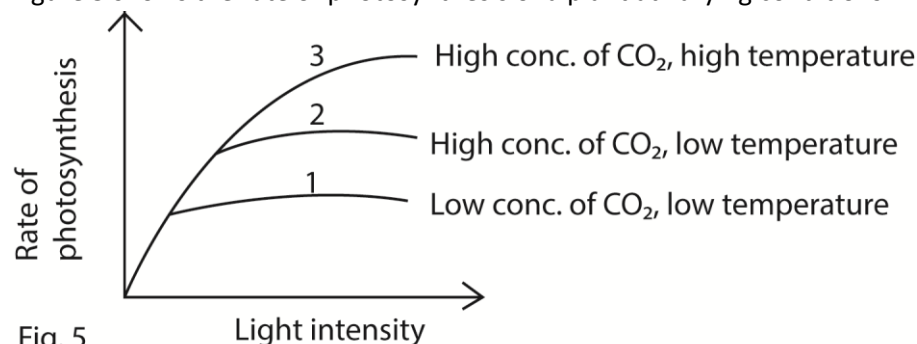


Fig. 5

Which factor is limiting photosynthesis in curve 2?

- A. carbon dioxide B. pH C. light intensity D. temperature

Answer is D

Increasing temperature from 2 increases the rate of photosynthesis

38. The desert frog has solved the problem of osmoregulation by

- A. having unique habitat

- B. possessing few glomeruli
- C. having a water proof skin
- D. possessing a long loop of Henle

Answer is B

39. Which one of the following is true of a fully contracted muscle fibre?

- A. the H-zone disappears
- B. the filaments shorten
- C. the band widens
- D. the sarcomere widens

Answer is A

40. Which one of the following is a function of the autonomic sympathetic system?

- A. Constriction of bronchioles
- B. Stimulation of tear glands
- C. Acceleration of heart beat
- D. Speeding up of gut movements

Answer is C

SECTION B (60MARKS)

41. (a) Explain the role of consumer and producer in recycling of carbon in nature

(i) Consumers (03marks)

- Respire and release carbon dioxide used by plants
- Are eaten by other animals and transfer carbon from one organism to another
- Die and decomposed by saprophytes that obtain carbon
- Die to form peat and fossil oil

(ii) Producers (02marks)

- Fix carbon dioxide during photosynthesis
- Respire to release carbon dioxide
- Die to form peat and fossil oil
- Decompose to release carbon compounds used by plants

(b) Give five reasons why all carbon in plants is not accessible to herbivores (5marks)

- some plants are not accessible
- some plant material such as cellulose are not digestible
- some plants are not eaten
- some plants are poisonous
- carbon compounds are respired

42. Figure 6 shows the effect of temperature on the rates of photosynthesis and respiration in well illuminated leaves.

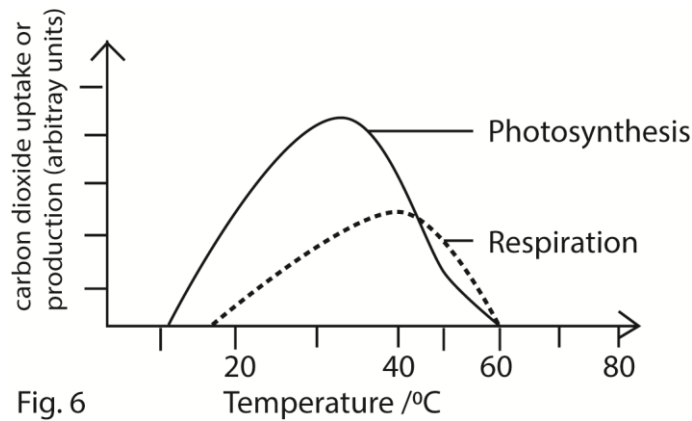


Fig. 6

(a) Compare the effect of temperature on the rate of photosynthesis and respiration. (04marks)

Similarities

- Increase in temperature causes both rates to increase
- Temperature beyond 40°C lead to decrease in both rates
- Rates are the same at 52°C and 60°C

Difference

- Rate of photosynthesis attains a peak at lower temperature than that of respiration
- Rate of photosynthesis begins to increase at lower temperature
- Photosynthesis attains a higher peak
- Beyond 52°C, the rate of respiration is higher than that of photosynthesis

(b) Explain the shapes of the curves (06marks)

Increase in temperature increases the rate of enzyme activity up to 40°C and beyond 40°C the rate of enzyme activities decrease because enzymes are denatured.

43. (a) Give one function of synapse in the nervous system (01mark)

- Transmit impulses between neurons
- Pass impulses in one direction
- Amplify impulses
- Allows adaptations to stimuli
- Allow coordination of impulses between different neurons

(b) When an action potential arrives at the synapse, calcium ions enter the neuron through presynaptic membranes.

(i) Explain how the calcium ions enter the neuron (02marks)

Arrival of the impulse causes calcium gates to open and causes Calcium ions diffuse into presynaptic knob

(iii) Describe the events which occur as a result of the entry of calcium ions to cause depolarization of post synaptic membrane. (05marks)

Calcium ions cause presynaptic vesicles to fuse with presynaptic membrane and release their transmitter substances into the synaptic cleft. The transmitter substance diffuse through the cleft and fuse post synaptic membrane cause to depolarization

(c) Explain the role of cholinesterase at synapse.

Cholinesterase inactivates acetylcholine preventing continuous firing of impulses.

44. Figure 7 shows a relationship between a pest and a biological control agent

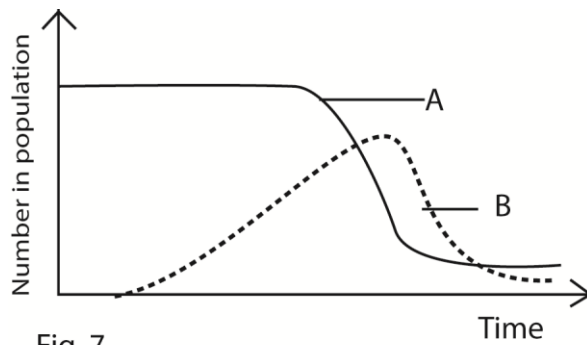


Fig. 7

- (a) Giving a reason state which curve represents the
- Pest (01mark)
B, because it is more abundant initially
 - Control agent (01mark)
A, begins with small number
- (b) Explain the changes in population of the pest and the control agent (05mark)
The population of the pest control increase due to availability of food; population of the prey decreases because is being feed on, the population of control agent then decrease due to lack of food until a dynamic equilibrium is established
- (c) Suggest what would happen if the pest was completely wiped out (02marks)
- the pest control may die out due to lack of food or;
 - the pest control may find alternative food source
- (d) Explain characteristics of a good biological control agent (01mark)
It should be specific
45. (a) Explain how changes in the solute potential of a cell affects its turgidity (04marks)
Increase in solute potentials cause water to enter a cell by osmosis; while a decrease in solute potential causes a cell to lose water by osmosis.
- (b) A plant cells with solute potential of -1240kPa and pressure potential of 350kPa was immersed in a sucrose solution whose water potential was -530kPa
- (i) calculate the water potential gradient between the cell and sucrose solution (03marks)
- $$\begin{aligned}\Psi_{\text{cell}} &= \Psi_s + \Psi_p \\ &= -1240 + 350 \\ &= -890\text{kPa} \\ \text{Water potential gradient} &= -890 - 530 \\ &= -350\text{Pa}\end{aligned}$$
- (ii) State the direction in which the water will flow (01mark)
From the sucrose solution into the cell
- (c) Outline the difference between plasmolysis and wilting (02marks)

Plasmolysis	Wilting
Only the protoplasm shrinks leaving the cell wall behind	The whole cell including the cell wall shrinks
Occurs when a plant cell loses water to a hypertonic solution by osmosis	Occurs when a plant cell loses water through evaporation

46. Figure 8 shows the oxygen dissociation curves for two species of fish, the carp and the mackerel. The carp lives in a pond with decomposing vegetation while the mackerel lives in the surface of the sea.

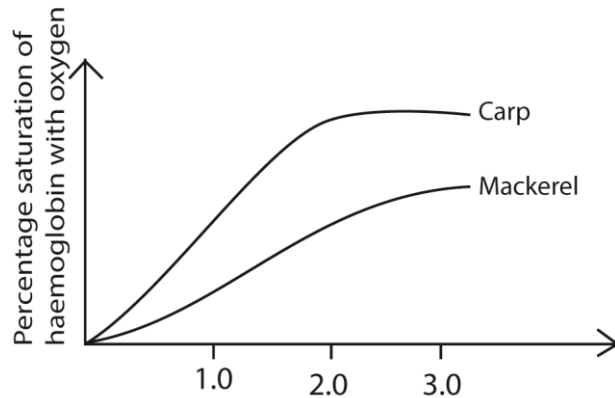


Fig. 8 Partial pressure of oxygen (kPa)

- (a) Describe how the percentage saturation of haemoglobin with oxygen changes with change in partial pressure of oxygen in the two species.
- (i) Carp (01mark)
Percentage saturation increases rapidly reaching maximum saturation at a lower oxygen partial pressure
 - (ii) Mackerel (01mark)
Percentage saturation increases gradually reaching maximum saturation at higher oxygen partial pressure
- (b) Explain the changes in percentage saturation of haemoglobin with the partial pressure of oxygen in the two species
- (i) Carp (04marks)
Lives in a habitat of low oxygen partial pressure due to oxygen usage by aerobic bacteria; therefore, carp's haemoglobin has higher affinity for oxygen to pick oxygen at low partial pressure
 - (ii) Mackerel (04marks)
Mackerel lives in a habitat of adequate oxygen partial pressure and therefore its haemoglobin has a lower affinity for oxygen.