

2024 Biology 6093/01 Answers

Question Number	Key	Question Number	Key	Question Number	Key	Question Number	Key
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2	A	12	C	22	D	32	B
3	B	13	D	23	C	33	D
4	C	14	A	24	A	34	B
5	B	15	A	25	C	35	B
6	B	16	A	26	A	36	C
7	A	17	D	27	D	37	C
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9	C	19	C	29	C	39	B
10	D	20	B	30	A	40	C

2024 Biology 6093/02 Answers

Section A

Qn	Answers	Remarks
1a	- underground / not exposed to sunlight + no need to absorb / convert light energy to chemical potential energy; (function of a root hair cell) to absorb water and mineral salt + does not carry out photosynthesis;	Weaker responses described the root hair cell as being 'underground' without reference to light or simply stated the function of root hair cells is to absorb water and mineral ions.
1b(i)	mitochondrion;	
1b(ii)	(mitochondrion) site of aerobic respiration + to release energy; - energy released is used to absorb mineral salts from the soils to the root; - against concentration gradient / from low concentration in the soil to high concentration in the cell sap of root hair cell; - mineral salts are used to synthesis amino acids / proteins or chlorophyll;	A common incorrect answer was to describe the uptake of water by active transport. Weaker responses indicated that energy could be used for photosynthesis or respiration.
1b(iii)	- endoplasmic reticulum - Golgi body / Golgi apparatus	A common incorrect response was 'ribosomes'
[Total: 9 marks]		

2a	(from distant object to near object) - diverging light rays reflected from the book are refracted through the cornea and the aqueous humour into the pupil; - ciliary muscles contract + relaxing their pull on the suspensory ligaments; - suspensory ligaments slacken + relaxing their pull on the lens; - lens becomes thicker and more convex + light rays reflected from the book are sharply focused on the retina;	Many candidates described the details of nervous coordination to bring about the changes, which were not required.
2b(i)	$\frac{5.8 - 2.5}{5.8} \times 100$ $= 56.897$ $= 56.9 \% \text{ (to 3 sf)}$	Weaker responses omitted the instruction and did not round the answer to three significant figures.
2b(ii)	to prevent excessive light from entering the eye + damaging the retina;	Weaker responses only referred to allowing less light to enter the eye.
2b(iii)	(moves into bright light) - circular muscles in <u>iris</u> contract + radial muscles of <u>iris</u> relax; - pupil becomes smaller / constricts;	Weaker responses referred to muscles constricting rather than contracting, referred to the radial muscles as the longitudinal muscles or referred to the circular muscles as the ciliary muscles.
[Total: 10 marks]		

3a(i)	(variation) refers to the differences in traits between individuals of the same species;	Many responses needed more details, often referring to differences without specifying between what.
3a(ii)	examples of continuous variation: human skin colour height weight	
3a(iii)	examples of discontinuous variation: green or yellow seeds in pea plants smooth or wrinkled seeds in pea plants ABO blood groups double to single eyelids Ability to roll the tongue	
3b(i)	• difference in shell shape, tortoise P has domed / rounded surface shell shape while tortoise Q has intermediate shell shape; • difference in the length of legs, tortoise P has shorter legs while tortoise Q has longer legs ignore: difference in body size	Some candidates talked about the overall size of the tortoises which could not be determined from the photographs without a scale.
3b(ii)	• spontaneous mutation took place + producing a new variant, i.e. long-necked tortoise; • longer neck tortoise were able to feed on other types of plants; • less competition among long-necked tortoise to feed on other types of plants / higher competition among shorter-necked tortoise to feed on ground level grass; • natural selection favoured long-necked tortoise; • long-necked tortoise were better adapted to the environment + survived and passed down the long neck gene / allele to the next generation; • over many generations, long-necked tortoise population increased and evolved into a distinct form;	Stronger responses began with a reference to 'mutation' and 'variation', as the basis for the evolution of the long-necked tortoise. Stronger responses described the passing of favourable alleles to the offspring and the increased frequency of these alleles in the population.
[Total: 10 marks]		

4a	carbon dioxide (gas);	
4b(i)	accept any value between 15 to 19;	
4b(ii)	using a gas syringe / measuring cylinder to measure the volume of carbon dioxide; measure carbon dioxide concentration using a probe; Accept: measure pH of water	Imprecise response referred to measuring the amount of gas using syringe / measuring cylinder.
4b(iii)	- limiting factor at light intensity 6 to 7: carbon dioxide concentration; - at 0.01% CO₂ concentration, as light intensity increases from 6 to 7, the number of bubbles per minute produced remains constant, at 27 per minute;	Some candidates mainly described how they knew it was not light intensity rather than giving evidence for why it was carbon dioxide.
4c(i)	(at 4°C) <i>prediction</i>: rate of photosynthesis decreases and remains low; <i>explanation</i>: enzymes are involved in photosynthesis + at 4°C, enzymes are inactive + lower rate of formation of enzyme-substrate complex;	Weaker responses referred to enzyme inactivity with no further explanation.
4c(ii)	(at 80°C) <i>prediction</i>: rate of photosynthesis is at 0 a.u. <i>explanation</i>: enzymes are involved in photosynthesis + at 80°C, all enzymes have been denatured;	
[Total: 9 marks]		

5a(i)	mitosis	Common errors included: 1. reference to production of genetically similar cells instead of genetically identical cells. 2. refence to mitosis enabling the growth of cells instead of growth of a tissue or the organism. 3. refence to mitosis enabling the repair of cells instead of growth of tissue repair.
5a(ii)	meiosis	Weaker responses showed lack of specificity, such as referring to 'haploid cells' rather than to 'gametes' or to 'reproduction' alone without qualification. Some referred to the production of genetically different cells without going to state how this results in genetically different offspring (leading to variation)
5b	human cells produced by mitosis contain 46 chromosomes while human cells produced by meiosis contain 23 chromosomes;	
[Total: 5 marks]		

6a	elements in a fat molecule: carbon, oxygen and hydrogen	
6b	• in the duodenum / small intestine, large fat droplets are emulsified / broken up into small fat droplets + by bile salts; • emulsification increases surface area to volume ratio of fats + speeding up digestion of fats by lipase; • in the small intestine, lipase digests fats into fatty acids and glycerol; • in the ileum, fatty acids and glycerol <u>diffuse</u> across the epithelium / wall of the villus into the bloodstream; • each villus contains a lacteal to transport the absorbed fats away and maintain a steep diffusion gradient;	Many candidates described the action of both bile and lipase in the digestion of fat molecules and gave comprehensive accounts.
6c	Any 2 from: • as a source and a long-term energy storage; • as an insulating material to prevent excessive heat loss, e.g. thick layer of fat beneath the skin; • a solvent for fat-soluble vitamins / hormones; • an essential part of cells, e.g. cell membranes; • oily substance secreted by the glands in the skin reduces water loss from the skin surface;	Weaker responses used imprecise language such as 'keeping us warm'.
[Total: 7 marks]		

7a	- only 10% of energy is transferred from one trophic level to the next, e.g. from arctic plants to arctic hare + 90% of energy lost to the environment as heat released via respiration / uneaten body parts / faeces / excretory products; - energy is needed to build biomass + less energy available will result in less biomass at higher trophic levels; - polar bear occupies trophic level 4 / final consumer in the food chain;	Some candidates only describe the loss of biomass or percentage energy losses at each level, rather than explaining the ways in which energy was lost. Weaker responses mixed up excretion and egestion, e.g. excretion of faeces.
7b(i)	[overall trend] from 1960 to 2020, CO₂ concentration increases from about 315 parts per million to 410 parts per million; - annual yearly fluctuations / small rise and fall each year; - sharp increase in CO₂ concentration between 2000 and 2020, as compared to between 1960 and 1980, and 1980 to 2000;	
7b(ii)	Any 3 from: - deforestation + less trees to absorb carbon dioxide through photosynthesis; - combustion of fossil fuels / coals / natural gases / oils + releases carbon dioxide into the air; - increasing energy demand and transportation + higher fossil fuel consumptions leads to higher carbon dioxide emission from motor vehicles; - industrial processes + manufacturing cement / steel releases carbon dioxide through chemical reactions;	
[Total: 8 marks]		

8a(i)		
8a(ii)		
8a(iii)	72 mg per dm ³ / min	
8a(iv)		
8b	- oxygen debt is the amount of oxygen required to remove lactic acid; (oxygen debt can be removed through) - continuation of high heart rate + to transport lactic acid from muscle cells to the liver + to transport oxygen from the lungs to the liver; - continuation of deeper and faster rate of breathing after a race / intense exercise + oxygen is used to break down lactic acid into carbon dioxide and water;	Weaker responses describe why the body undergoes anaerobic respiration during vigorous exercise and how the lactic acid is transported to the liver to be broken down.
[Total: 12 marks]		

Qn	Answer	Remarks
9a	Contains dead or weakened influenza viruses	Candidates should give a correct description of what the vaccine contained. The disease should not be confused with the pathogen or virus.
b	This is to ensure that the vaccine remains effective against new variants/mutation of the influenza viruses which mutates rapidly and changes surface antigens. The mutated virus with new antigens would prevent the immune system from recognising the virus. The antibodies currently in bloodstream from previous vaccinations would be ineffective against the new variants.	Candidates should understand the idea of mutation or different variants of the virus. Candidates should describe that new vaccines would be needed for the new variants which might have different antigens. Stronger response should explain that antibodies that were currently in the bloodstream, or the cells that produced them, would be ineffective against the new variant.
c	Antibody production begins slowly and peaks two weeks after vaccination whereas antibody production increase sharply half a week after infection. After infection, antibody production reaches a much higher concentration of antibody, about 3.5 times more than after vaccination. As the vaccination introduced a weakened form of virus, time was needed for the immune response and production of antibodies after vaccination.	Responses should be comparative and describe how it took time for the triggering of the immune response and production of antibodies after vaccination, whereas after infection there was a much shorter delay.
d	Antibiotics target the structures of bacteria like cell wall, cell membrane and act on ribosomes to inhibit protein synthesis and growth. As the viruses do not have the cell wall, cell membrane and do not have ribosomes, antibiotics would not be effective against viruses.	Descriptions of the action of antibiotics on bacterial cell walls, cell membranes and ribosomes should be matched by explanations that viruses did not have these structures

10ai	Fish-eating birds	
10aii	As DDT is non-biodegradable, DDT would be stored in fatty tissues and cannot be excreted, the concentration of DDT would increase in each organism through bioaccumulation. Water is taken by the plankton which is then taken by the small fish, which is eaten by the large fish that is eaten by fish-eating birds. Up the food chain, the DDT is passed from one trophic level to the next with increasing concentration. The top consumer, bird eating fish, then accumulate large amounts of DDT.	Candidates should explain why DDT increases in concentration up the food chain with the correct use of the scientific terms 'bioaccumulation' and 'biomagnification'.
10bi	Transgenic organism is an organism that contains genes from another species.	
10bii	A restriction enzyme is used to isolate the identified gene from <i>Bacillus thuringiensis</i>. A plasmid cut with the same restriction enzyme is sealed to the plasmid with DNA ligase. The plasmid is then inserted to the cotton plant cells using temporary heat or electric shock. The cells that have taken the recombinant plasmid will start to express the gene and producing the toxins.	Candidates should apply their knowledge of the genetic engineering of transgenic bacteria to transgenic eukaryotic cells. Answers should describe the bacterial gene into the cotton plant.