

MCQ

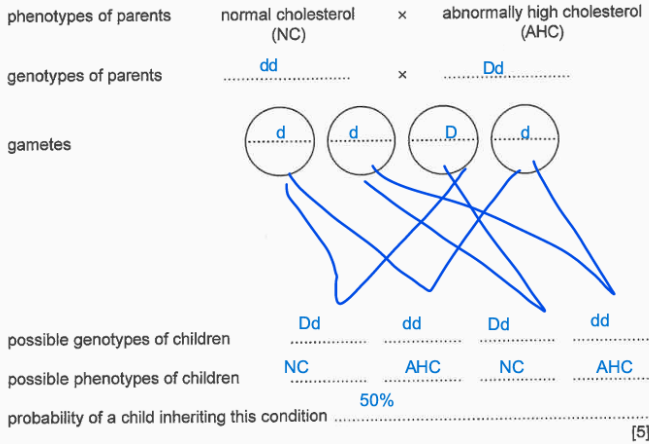
1	2	3	4	5	6	7	8	9	10
A	C	C	D	B	A	B	B	A	A
11	12	13	14	15	16	17	18	19	20
B	B	C	D	D	D	D	B	C	B
21	22	23	24	25	26	27	28	29	30
A	C	B	C	A	C	A	C	B	D
31	32	33	34	35	36	37	38	39	40
B	B	A	D	C	A	C	B	C	B

Qn	Answers	Remarks
1a	3	Candidates should identify that 3 is protein based on the peptide bonds present.
1b	Production of protein-digesting enzymes: C, D and H. Protein digestion: C and H.	Students need to identify all the correct parts of the digestive system. The two sites of protein digestion were more well known than the three sites of production of protein-digesting enzymes.
1c	Protease.	
1d	Assimilation: amino acids; are absorbed by body cells and used to synthesise proteins for growth/repair and form protein such as enzymes/hormones; Removal: excess amino acids are deaminated in the liver; the amino group is converted to urea; urea is carried to kidneys and excreted in urine.	Candidates need to recognise that the products of protein digestion were amino acids. Candidates should not spend unnecessary time and space describing digestion and absorption, as the question indicated that only events post-absorption were required. Candidates need to show understanding that the

		deamination of amino acids occurs in the liver with the production of urea. They do not need to provide detail about the route of urea around the circulatory system between liver and kidney. Students should also show understanding of the excretion of urea by the kidney in urine. Students should also show understanding of how amino acids are being used in the production of new proteins or of named proteins such as enzymes.
2a	M: G = 21, T = 14, A = 11. N: G = 36, T = 11.	The numbers of bases for each strand should both add up to 82 (million). Candidates need to recognise the number of cytosine bases on the N strand should be the same as the number of guanine bases on the M strand using understanding of complementary base pairing. Hence, the number of thymine bases on the N strand must be 11, so the total on that strand could be 82.
2b	Different DNA base sequences give different base triplets/codons (and mRNA codons); As sequence of base codes for a sequence of amino acids; so different amino acids may be joined in a different sequence, producing a different polypeptide.	Candidates should go beyond identifying that the two base sequences were different. Candidates should also describe the idea that the sequence of bases codes for a sequence of amino acids; hence the different amino acid sequences equate to different polypeptides. Description of DNA replication would not answer the question.
3ai	P: cell surface membrane Q: cytoplasm	Candidates should only name the structures in the cell body.

		There is no specialised names required. Candidates should not repeat labels already on Fig. 3.1, such as cell body or dendrites.
3a ii	Myelin sheath insulates the nerve fibre and increases the speed of nerve impulse transmission; It has a long nerve fibre to carry the nerve impulses away from cell body across long distances in the body; There are highly branched dendrites attached to cell body that provide large surface area to receive incoming signals or neurotransmitters from neighbouring neurones;	Candidates should use the information in the introduction or on Fig. 3.1 and instead suggested structures which were not in the figure. Candidates need to go beyond naming the structural adaptation, and provide explanation to link the structure correctly to an explanation.
3b i	Any two: retina/ <u>eye</u> ; <u>nose</u> /olfactory epithelium; taste buds on <u>tongue</u> .	Candidates should the names of two appropriate sense organs; Some gave names of components of those sense organs, such as 'retina'. Answers such as paws, whiskers and skin are acceptable as none could be used to detect food. Candidates should also not describe type of receptor, rather than its location.
3b ii	Leg <u>muscle</u> / skeletal <u>muscle</u> .	The term effector should be understood by candidates. Candidates should not just state 'legs' or give other parts of the overall response, such as the stimulus or the cat's response
3b iii	sensory neurone -> relay neurone -> motor neurone	Students should include the sensory neurone in the sequence of neurones. Other additional and unnecessary detail do not need to be given including receptors, the location of the relay neurone and the effect; when only the three neurones, in sequence were required.

3ci	Factor 1: myelin sheath - Reason fibres 1-3 are much faster than unmyelinated fibre 4 which has the lowest speed of nerve impulse at 2 m per seconds; Factor 2: nerve-fibre diameter Reason: among myelinated fibres, larger diameter is associated with higher speed ($1 > 2 > 3$), where nerve fibre 1 with thickest diameter followed by fibre 2 and 3 has speed from 100m per seconds for nerve fibre one which is faster than nerve fibre 2 by 20m per seconds and fibre 3 by 60m per seconds;	Candidates need to describe the evidence for their two selected factors, using the neurone numbers or describing the variation in the feature and how this affected impulse speed.
3cii	Myelination has the greater effect. Fibre 3 is myelinated and conducts at 40 m s^{-1}, whereas similar/small unmyelinated fibre 4 conducts at 2 m s^{-1} at about 20× difference; Diameter differences among 1-3 give a smaller change.	Candidates should consider the two factors they had identified in the previous question and select the one which had the most impact. The explanation of the choice should compare the evidence for the two factors previously given.
4a	Nucleus.	Candidates should show understanding of the term organelle.
4b	Condition is caused by dominant allele; Persons 7 and 8 are unaffected, so both only have recessive alleles; Hence, every child only receive recessive alleles from each parent and are unaffected.	Candidates need not explain how person 7 came to be homozygous recessive by considering her parental genotypes and inheritance of that genotype. Instead, candidates should include the idea that the offspring of parents 7 and 8 would have to inherit, or be passed down, recessive alleles from both parents. Candidates should not simply state that as 7 and 8 were both homozygous recessive, then their children would also have this genotype, without explaining how they came to get these alleles.

4ci	Person 16: dd. Person 20: Dd. Gametes: d × (D or d). Children: Dd affected and dd normal, 1:1. Probability affected = $1/2 = 50\%$.  phenotypes of parents normal cholesterol (NC) × abnormally high cholesterol (AHC) genotypes of parents dd × Dd gametes possible genotypes of children Dd dd Dd dd possible phenotypes of children NC AHC NC AHC probability of a child inheriting this condition 50% [5]	Genetic diagram completed well should show correct haploid gametes and incorrect parental genotypes.
4cii	Each fertilisation is an independent random event; A 50% probability does not mean exactly half of a small family must be affected and one of six can occur by chance as the chance of inheriting particular alleles is not affected by previous fertilisation; The sample is also too small a sample and expected ratio will not be expressed;	Candidates should show that fertilisation is random and express the idea that the chance of inheriting any particular allele is not affected by previous fertilisations.
4d	Cholesterol/fatty deposits build up in coronary artery walls, narrowing/blocking the lumen; Blood flow with oxygen and glucose delivery to heart muscle fall; heart muscle cannot respire sufficiently and cells may die, causing a heart attack.	Candidates should identify clearly the coronary artery as the key vessel in which deposition of fat in blood vessels occurred.
5a	Level in glass tube rises; The 10% solution has higher water potential than the 40% solution; Water molecules move through the partially permeable membrane by osmosis from higher to lower water potential, increasing volume/pressure inside and causing the increase in liquid up the tube;	Candidates should show understanding of osmosis and water potential and the level of the liquid in the tube would rise or increase due to the differences in water potential in the beaker and the bag, thus causing water molecules to enter the bag.
5bi	Water molecules enter by osmosis, but the rigid cell wall resists the increased internal/turgor pressure and prevents bursting.	Cell wall is the key factor in preventing the bacterial cell from bursting and candidates should make reference to the cell wall ensuring the cell

		became turgid, rather than bursting.
5bii	Draw an antibody whose binding site is complementary in shape to one antigen and show it bound to that antigen.	Candidates are not expected to know the details of antibody structure and should draw an antibody complementary to either the unique part of the antigen or the whole of it. Candidates should follow the instruction and draw the diagram in the figure.
5c	Example - Transmission: droplets/aerosols from coughs/sneezes. Reduce transmission: cover coughs, mask, hand hygiene and/or avoid close contact when ill. Signs/symptoms: cough, fever, chest pain, difficulty breathing. Long-term prevention: pneumococcal vaccination.	Correct methods of transmission usually revolved around airborne droplets from coughs or sneezes. The use of masks is one key method to reduce transmission along with isolation. Candidates should not suggest the use of antibiotics, or ensuring the completion of such a course, for long-term prevention, which was insufficient as these often give only short-term protection and vaccination is needed.
6ai	A donor -> A, AB. B donor -> B, AB. AB donor -> AB only. O donor -> A, B, AB, O.	Candidates should use the key provided to give a clear indication of their responses.
6aii	Group O plasma contains anti-A and anti-B antibodies; A/B/AB donor red cells carry A and/or B antigens. Antigen-antibody reaction causes agglutination, which can obstruct blood flow and be dangerous.	Candidates should be able to describe that blood of group O possessed antibodies a and b. Candidates should be able to explain agglutination due to binding between the antibodies in the blood of the group O recipient and antigens on the red blood cells of the donor.
6b	PFCs mainly replace oxygen transport but not all blood functions: e.g. no white blood cells/antibodies for defence and no platelets/clotting factors for clotting.	Candidates should not state that the PFCs would be attacked by white blood cells or simply rejected by the

		body as information provided showed that these are used in patients. Candidates should show understanding that substituting whole blood with oxygen carriers would leave the patient deficient in the other components of blood and their functions.
7ai	Plot: (1960,100), (1970,300), (1980,800), (1990,1800), (2000,3200), (2010,6000), (2015,8000). Use suitable linear scales, label axes/units, and join appropriately. Axes with units: X: Year, Y: quantity of plastics manufactured/ billion kg; Scale - even scale, Plots, Line	Candidates should note that the scales should be linear throughout and should take up more than half the available grid in both directions and have a smooth curve.
7aii	Approximately 2500 billion kg.	Almost all candidates completed this question well. Appropriate construction lines were drawn and the reading from them was accurate. Better performing candidates clearly showed their working on the graph.
7b	$748.20 : 2.34 = 12470 : 39 \approx$ $320 : 1.$	Candidates need to calculate ratios in the 'simplest form'. The best way of expressing ratios is as a value to 1.
7ci	Upright pyramid of numbers, bottom to top: microscopic plants -> shrimp -> tuna -> orca.	Candidates should construct an appropriate pyramid of numbers and label it correctly/
7cii	Biomass is the total dry mass of living material/organisms in a given area.	Candidates need to provide correct definition to either fresh mass or dry mass.
7ciii	Microscopic plants reproduce/grow rapidly and have high turnover, but are eaten rapidly by shrimp. Thus standing producer biomass at any one time can be	Candidates should not only repeat or paraphrase the

	lower than primary-consumer biomass.	words in the question. Responses should not only refer to the size and mass of the producers themselves, but a comparison with the primary consumers.
8ai	The use of insulin pump results in smaller fluctuations of blood glucose concentration from 80 mg per 100cm³ to 140 mg per 100cm³ as compared to insulin injections that could fluctuate between 120 mg per 100cm³ to 360 mg per 100cm³; Insulin pump has much lower post-meal peaks that results in blood glucose concentration that remains closer to the 80-180 target for more of the day as compared the insulin injections that could raise up to 360 mg per 100cm³; Insulin pump has lesser time at very high blood glucose concentration of about 1 to 2 hours as compared to insulin injections that is about 2 to 3 hours; Insulin pump allows for small continuous doses day/night and programmable extra doses around meals as compared to repeated syringe injections.	Candidates can describe the smaller fluctuations for those using the insulin pump; Candidates should not repeat the information they had been given or explained the effect of the treatment on blood sugar concentrations. Candidates should describe the effect of the insulin pump in comparison with having insulin injections
8aii	Read person A at 12.30 pm and 1.30 pm from the graph, then calculate: (final - initial) / initial × 100. Using reasonable readings gives approximately 120-135% (about 130%). $330-130/130 \times 100 = 150$	Candidates should show formula clearly
8b	Exercise increases aerobic respiration and glucose uptake/use by muscle cells to release energy, lowering blood glucose; Regular exercise can also increase sensitivity/responsiveness to insulin, improving uptake and control;	Candidates should not describe respiration as 'producing energy' Candidates should link different processes to exercise and its effect on blood sugar concentration. Candidates need not describe effects of glycogen

9ai	Wheat roots have the highest mean concentration at 2.31 arbitrary units in the roots as compared to xylem 1.62, leaves 0.02, phloem 0.0;	Candidates need to indicate the correct plant and supporting information
9aai	A small amount absorbed by roots is transported upward to leaves in the xylem/transpiration stream.	Candidates should explain how the toxic substances are transported to leaves from roots in the xylem instead of through the stomata. Candidates should also include the correct vascular tissue.
9aiii	Total soybean concentration = $0.62 + 0.94 + 0.73 + 0.48 = 2.77$. $(0.73 / 2.77) \times 100 = 26.4\%$ (1 d.p.).	Answers should be rounded off to 1dp.
9b	Aphids ingest pesticide from treated plants, where the pesticides cannot be excreted and stored; Birds eat many aphids, so pesticide from many prey enters each bird and accumulates. As the pesticide is not readily broken down/excreted, it accumulates within the aphids and then birds and the concentration increases at higher trophic levels leading to biomagnification.	Candidates should describe the bioaccumulation within the aphids and the biomagnification of the pesticide along the food chain.
9c	Vascular bundles are arranged in a ring in a herbaceous dicot stem; Phloem lies on the outer side of each bundle, outside xylem; It contains elongated sieve tube elements joined end-to-end with perforated sieve plates, with companion cells adjacent;	Sieve plates should not be confused with sieve tube elements. The presence of companion cells should be stated and include the position and structure of phloem.