Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Subsidiary Level in Biology

WBI11/ 01A

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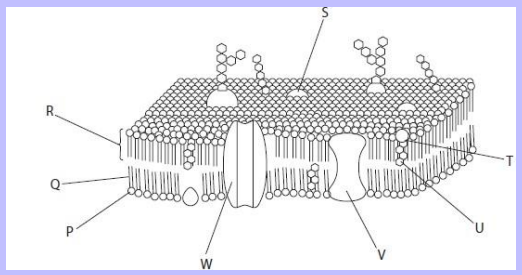
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

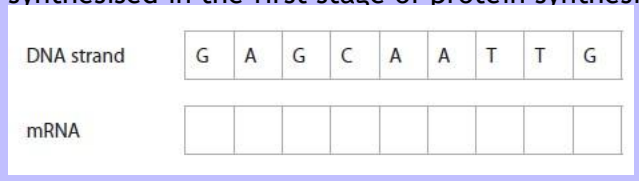
Question number	The diagram shows some structures in part of a cell membrane.  Which one of these pairs of structures is made of protein? **Answer**	**Mark**
1(a)(i)	The only correct answer is **D** ***A*** *is incorrect as P is a phosphate* ***B*** *is incorrect as P is a phosphate and Q is a fatty acid* ***C*** *is incorrect as Q is a fatty acid*	**(1)**

Question number	Which one of these pairs of structures is nonpolar (hydrophobic)? **Answer**	**Mark**
1(a)(ii)	The only correct answer is **B** ***A*** *is incorrect as P is a phosphate* ***B*** *is incorrect as T is the hydrophilic part of cholesterol* ***C*** *is incorrect as W is a channel protein*	**(1)**

Question number	Which structure requires ATP to function? **Answer**	**Mark**
1(a)(iii)	The only correct answer is **D** ***A*** *is incorrect as R is a phospholipid* ***B*** *is incorrect as T is the hydrophilic part of cholesterol* ***C*** *is incorrect as U is cholesterol*	**(1)**

Question number	Explain how the properties of the cell membrane enable a cell to release extracellular enzymes by **exocytosis.** **Answer**	**Additional guidance**	**Mark**
1(b)	An explanation that includes the following points: • because the cell membrane is fluid / as the phospholipids are moving (within the membrane) (1) • therefore, the cell membrane and vesicle membrane can {merge / fuse} (1)	**IGNORE** reference to mosaic model/ **IGNORE** phosphate heads alone **DO NOT ACCEPT** phospholipid bilayer moving **DO NOT ACCEPT** in context of vesicle formation	**(2)**

Question number	The process of protein synthesis occurs in two stages and involves: • messenger RNA (mRNA) • transfer RNA (tRNA) • enzymes. Name the first stage that produces mRNA using DNA as a template and the second stage that involves tRNA. **Answer**	Additional guidance	Mark
2(a)	• First stage transcription • Second stage translation (1)	Both points needed for mark **ALLOW** transcribe **ALLOW** translate	**(1)**

Question number	The diagram shows the sequence of bases on part of a DNA strand. Complete the diagram to show the sequence of bases on the mRNA strand synthesised in the first stage of protein synthesis.  **Answer**	Additional guidance	Mark
2(b)(i)	• C U C G U U A A C (1)		**(1)**

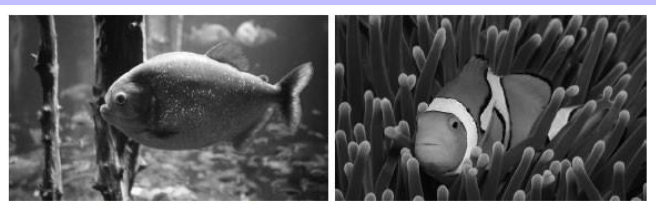
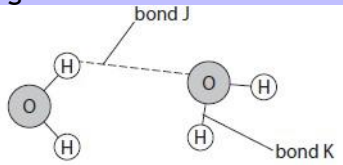
Question number	Describe the role of enzymes in the synthesis of mRNA using a **DNA molecule.** **Answer**	**Additional guidance**	**Mark**
2(b)(ii)	A description that includes 2 of the following points: • RNA polymerase unwinds the DNA helix (1) • RNA polymerase lines up the (RNA) nucleotides against the DNA strand (1) • RNA polymerase involved in detecting mistakes in mRNA synthesis (1)	**ACCEPT** DNA helicase / DNA Gyrase / an enzyme as a named enzyme **ACCEPT** breaks hydrogen bonds (holding helix) / unzips as alternative for unwind **IGNORE** breaks unqualified **IGNORE** catalysing **DO NOT ACCEPT** DNA polymerase **ACCEPT** forms phosphodiester bonds between nucleotides **ACCEPT** repairs mistakes made during synthesis of mRNA	**(2)**

Question number	The second stage of protein synthesis involves mRNA and tRNA. The table shows some information about the structures present in mRNA and tRNA. Put one cross [×] in the appropriate box in each row, in the answer book, to show whether the structure is present in these molecules. **Answer**	Additional guidance	Mark
2(c)(i)			(2)

Structure	Present in molecules of			
	A mRNA only	B tRNA only	C both mRNA and tRNA	D neither mRNA nor tRNA
single polynucleotide				
phosphodiester bonds				

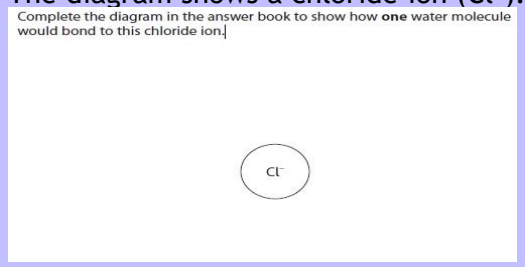
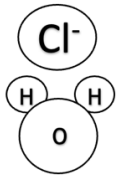
Structure	Present in molecules of			
	mRNA only	tRNA only	both mRNA and tRNA	neither mRNA nor tRNA
single polynucleotide	[x]	[x]	[x]	[x]
phosphodiester bonds	[x]	[x]	[x]	[x]

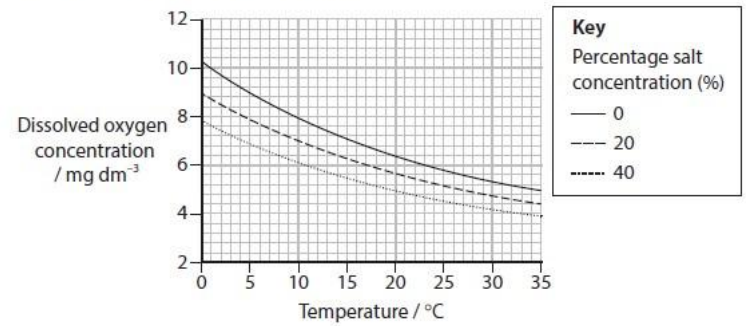
Question number	Describe the role of tRNA in the second stage of protein synthesis. **Answer**	**Additional guidance**	**Mark**
2(c)(ii)	A description that includes two of the following points: • {binds to / carries} its (specific) amino acid to the ribosome / (m)RNA (1) • and holds it in place until peptide bond forms (1)	**ACCEPT** collects **ACCEPT** description of tRNA interacting with (m)RNA	**(2)**

Question number		Mark
	 (Source: © Nic Cleave Photography/ Shutterstock) Piranha (Source: © WaterFrame/Alamy) Clown fish The photographs show two species of fish, a piranha and a clown fish. Piranha live in freshwater and clown fish live in salt water. Both species of fish use oxygen dissolved in water. The diagram shows two water molecules.  Which row of the table shows the names of these two bonds? |	Bond J | Bond K | |---|---|---| | A | covalent | ester | | B | covalent | hydrogen | | C | hydrogen | covalent | | D | hydrogen | ester | **Answer**	
3(a)(i)	The only correct answer is **C** ***A** is incorrect as J is a hydrogen bond and K is a covalent bond* ***B** is incorrect as J is a hydrogen bond* ***D** is incorrect as K is a covalent bond*	**(1)**

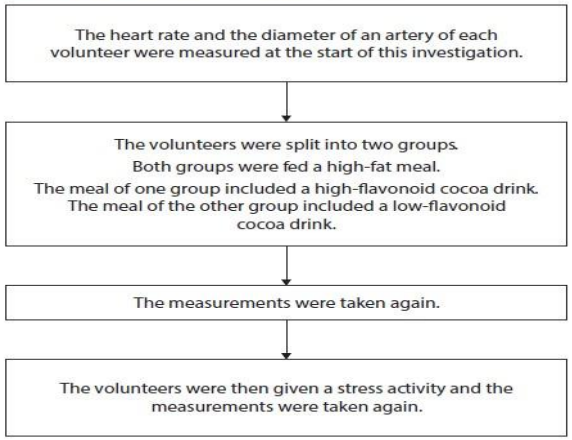
Question number	Bond lengths are sometimes measured in Angstrom units (Å). 1×10^7 Å = 1 millimetre (mm) 1 mm = 1×10^6 nanometres (nm) The length of bond K is 0.958 Å. Calculate the length of bond K in nm. **Answer**	**Additional guidance**	**Mark**
3(a)(ii)	• 0.0958 / 9.58×10^{-2} (nm) (1)	**ACCEPT** 0.096 or 9.6 x10^{-2}	**(1)**

Question number	Salt water is formed when sodium chloride (salt) dissolves in water. Which row of the table describes the salt and the water? |	Salt	Water
A	solute	solution
B	solute	solvent
C	solvent	solution
D	solvent	solute | **Answer**	**Mark**
3(b)(i)	The only correct answer is **B** ***A** is incorrect as water is the solvent* ***C** is incorrect as salt is the solute and water is the solvent* ***D** is incorrect as salt is the solute*	**(1)**

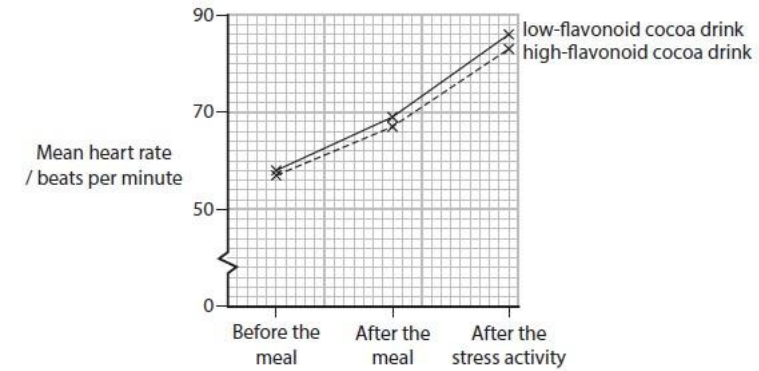
Question number	The diagram shows a chloride ion (Cl^-).  **Answer**	**Additional guidance**	**Mark**
3(b)(ii)	• A water molecule drawn with H facing the chloride ion	 **ACCEPT** more than one water molecule is drawn, provided they are all correct If charges are shown these must be correct. **DO NOT ACCEPT** overlapping circles **DO NOT ACCEPT** Solid lines between Hydrogen and Chloride. **DO NOT ACCEPT** water molecule drawn incorrectly	**(1)**

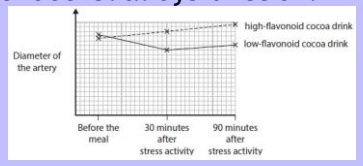
Question number		Additional guidance	Mark
	The graph shows the effects of temperature and salt concentration on the dissolved oxygen concentration in water.  Describe **two** conclusions about the effects of temperature and percentage salt concentration on the dissolved oxygen concentration. **Answer**		
3(c)(i)	A description that includes the following points: • (at all salt concentration) as temperature increases, the dissolved oxygen concentration decreases (1) • as percentage salt concentration increases, the dissolved oxygen concentration decreases (at the same temp/ as the temp increases) (1)	**ACCEPT** the converse **DO NOT** piece together **ACCEPT** negative correlation **IGNORE** negative correlation.	**(2)**

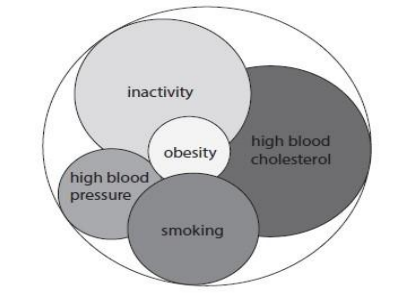
Question number	Gills are the gas exchange surfaces of fish. Fish obtain oxygen that is dissolved in the water flowing over their gills. Explain why an increase in temperature can cause fish to die. Use the information in the graph and your knowledge of gas exchange surfaces to support your answer. **Answer**	**Additional guidance**	**Mark**
3(c)(ii)	An explanation that includes the following points: • (as temperature of the water increases) there will be less oxygen so the { concentration/diffusion } gradient will be lower (1) • therefore less oxygen will <u>diffuse</u> / gas exchange will reduce (into the fish)(1) • if oxygen not enough for respiration (the fish will die)(1)	If diffusion gradient given in mp1 accept this as an alternative for diffuse **IGNORE** No oxygen	**(3)**

Question number		Additional guidance	Mark
	Stress can result in a person eating unhealthy food that can result in an increased risk of cardiovascular disease (CVD). Flavonoids are molecules found in cocoa drinks. The effect of cocoa drinks on reducing the effect of stress on heart rate was investigated. The effect of cocoa drinks on endothelial function after eating an unhealthy, high-fat meal was also investigated. The flowchart outlines the method used in this investigation.  The high-flavonoid cocoa drink contained 695.00 mg of flavonoids, and the low flavonoid cocoa drink contained 5.60 mg. Calculate the percentage difference in the mass of flavonoids between these two drinks. Use the formula: $$\text{percentage difference} = \frac{\text{difference between the two values}}{\text{mean of the two values}} \times 100$$ Give your answer to **three** significant figures.		

	Answer		
4(a)	• correct percentage not rounded to 3 sig figs / correct working shown (1) • 197 % (1)	= (689.4 ÷ 350.3) x100 = 1.9680274050 x 100 **ACCEPT** bald answer for 2 marks = 197 % 196.80274050 = 1 mark	**(2)**

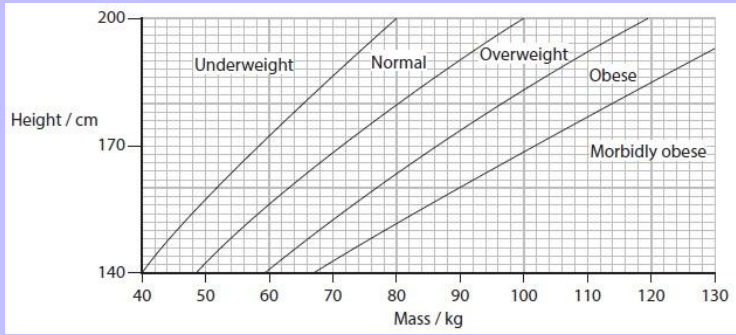
Question number		Additional guidance	Mark
	 The graph shows the mean heart rate during this investigation Describe **three** conclusions that can be made from the data shown in the graph. **Answer**		
4(b)	A description that includes the following points: • heart rate increases after eating the meal (1) • heart rate increases following the stress activity / after the stress activity has highest heart rate (1) • high flavonoids do not lower the heart rate / lowers the heart rate (slightly) (1)	**IGNORE** references to CVD / CHD **ALLOW** stress activity increases the heart rate more than the meal	**(3)**

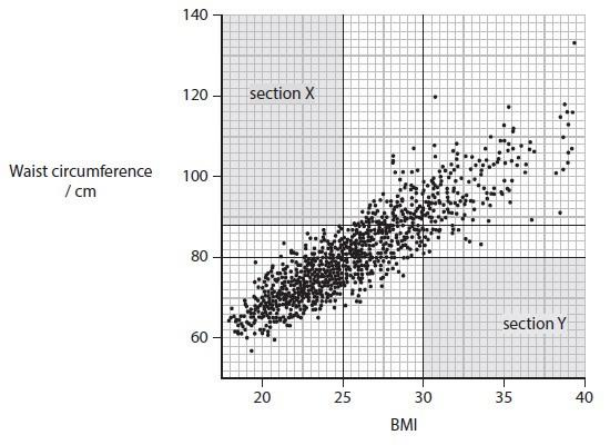
Question number	If the endothelial lining is damaged, the response to an increase in blood flow is reduced. The graph shows the changes in the diameter of the artery during this investigation. A decrease in the diameter of the artery indicates endothelial dysfunction.  Explain why including a high-flavonoid drink with a meal could help to reduce the risk of CVD due to stress and unhealthy meal choices. Use the information in the graph and your own knowledge to support your answer. **Answer**	**Additional guidance**	**Mark**
4(c)	An explanation that includes four of the following points: • high flavonoids increased the diameter of the artery (after the stress activity) / low flavonoids decreased the diameter of the artery (after the stress activity) (1) • which means that high flavonoids are reducing endothelial dysfunction/ damage to endothelial walls / damage to endothelium (1) • (reducing endothelial dysfunction will) reduce an inflammatory reaction (1) • therefore {plaque / atheroma} is less likely to build up (1) • not eating unhealthy meals will reduce the {salt / cholesterol / saturated fat} intake, reducing the risk of CVD (1)	**ACCEPT** lining of arteries for endothelial wall **IGNORE** atherosclerosis reference **ALLOW** in context of eating healthy meals	**(4)**

Question number	The risk of developing coronary heart disease (CHD) is influenced by several factors. The diagram represents the contribution of five risk factors to the development of CHD. The large circle represents **all** cases of CHD and has an area of 1600 π mm^2. The area of each shaded circle is proportional to the number of cases resulting from each risk  The diameter of the circle representing obesity is 20 mm. Calculate the percentage of all cases of CHD resulting from obesity. **Answer**	**Additional guidance**	**Mark**
5(a)(i)	• area of circle representing obesity calculated as 100 π (1) • 6 / 6.3 / 6.25 (%) (1)	25% awards 1 mark Bald answer = 2 marks	**(2)**

Question number	The area of CHD resulting from smoking is 256 π mm^2 Calculate how many times more cases result from smoking than from obesity. **Answer**	**Additional guidance**	**Mark**
5(a)(ii)	• 2.56 / 2.6 / 3 (1)	**ALLOW** for 25% in 5ai = 0.64 / 0.6 **DO NOT ALLOW** 2.56 π	**(1)**

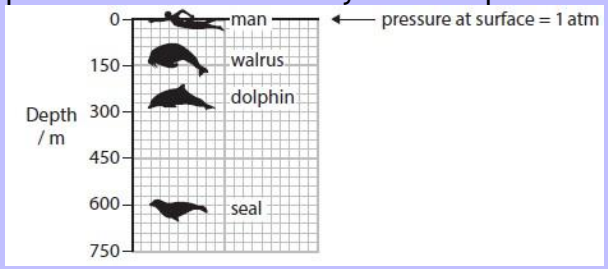
Question number	Explain how smoking increases the risk of developing CHD. **Answer**	**Additional guidance**	**Mark**
5(a)(iii)	An explanation that includes four of the following points: • smoking increases blood pressure (1) • increase in blood pressure damages the {endothelial lining / endothelial cells / lining of blood vessels} (1) endothelium • resulting in an {inflammatory response / inflammation} (1) • causing formation of a {plaque / atheroma / cholesterol build up} (1) • {reduces flow of blood / blocking blood flow} to the heart {muscle / tissue / cells} (1	**IGNORE** walls of blood vessels **ACCEPT** white blood cells accumulate in the damaged areas / accumulation of foam cells **ACCEPT** blood clot **ACCEPT** block flow through coronary artery **ACCEPT** narrowing	**(4)**

Question number	Body mass index (BMI) is an obesity indicator. The chart can be used to work out an individual's BMI category.  State the BMI category of an individual who has a mass of 73 kg and a height of 164 cm. **Answer**	**Additional guidance**	**Mark**
5(b)	• overweight (1)		**(1)**

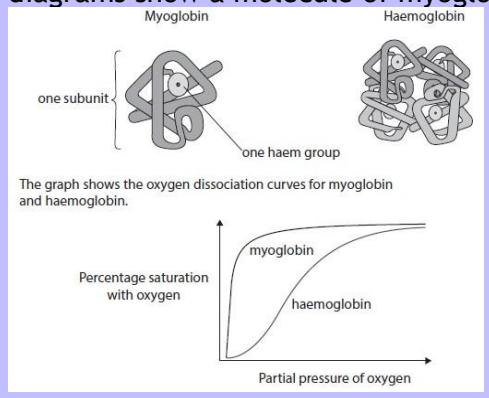
Question number	Waist circumference is also an obesity indicator. The graph shows the relationship between BMI and waist circumference. Each black dot represents an individual.  State the relationship between BMI and waist circumference. **Answer**	**Additional guidance**	**Mark**
5(c)(i)	• positive correlation / as BMI increases so does waist circumference (1)	**ACCEPT** directly proportional **IGNORE** positive relationship	**(1)**

Question number	An individual with a BMI of $\geqslant 25$ and < 30 is considered overweight. Give the waist circumference of the individual who is overweight and has the least risk of CHD. **Answer**	**Additional guidance**	**Mark**
5(c)(ii)	• 68(1)	**DO NOT ACCEPT** a range	**(1)**

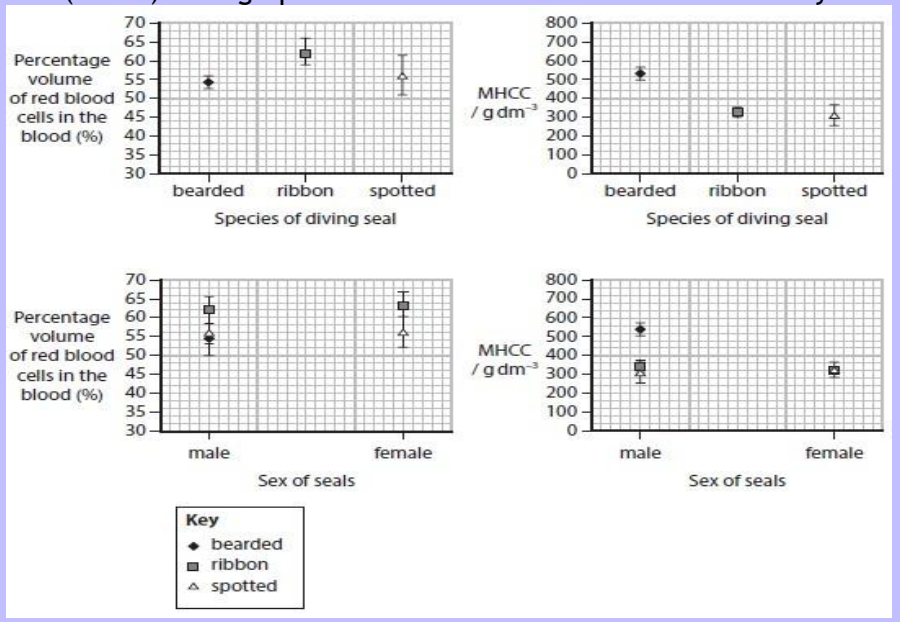
Question number	Suggest **one** reason why there are no black dots in the shaded parts of the graph labelled section X and section Y. **Answer**	**Additional guidance**	**Mark**
5(c)(iii)	• a person with a high BMI is unlikely to have a small waist / a person with a low BMI is unlikely to have a big waist (1)	**IGNORE** references to possibility. **ACCEPT** there are no people tested that were in this range	**(1)**
Question number	Explain why using waist circumference together with BMI gives a more accurate indication of the risk of developing CHD than using BMI only. **Answer**	**Additional guidance**	**Mark**
5(c)(iv)	An explanation that includes the following points: • the distribution of fat is important (1) • Idea that BMI does not take into account muscle	**ACCEPT** pregnancy changes **ACCEPT** people are different shapes **IGNORE** waist : hip ratio e.g. muscle weighs more different to fat e.g. people have different proportions of muscle e.g. people have different bone densities	**(2)**

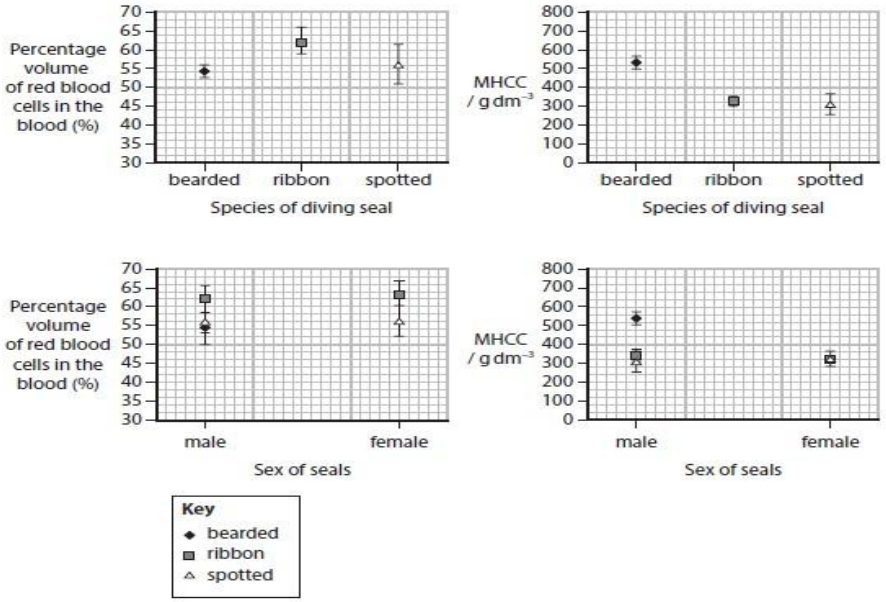
Question number	Some animals that live in the water are adapted for diving. The pressure at the water surface is one atmosphere of pressure (atm). For each 10 m an animal dives, the pressure on it increases by 1 atm of pressure. The diagram shows the depths that three animals can dive to.  How many times greater is the pressure exerted on the walrus when it dives to 100 m than when it dives to 70 metres? **A** 1.25 times more **B** 1.38 times more **C** 1.43 times more **D** 1.57 times more **Answer**	**Mark**
6(a)	The only correct answer is **B** ***A** is incorrect as pressure at 70 m = 8 atm and pressure at 100 m = 11 atm, 11 ÷ 8 = 1.375 = 1.38* ***C** is incorrect as pressure at 70 m = 8 atm and pressure at 100 m = 11 atm, 11 ÷ 8 = 1.375 = 1.38* ***D** is incorrect as pressure at 70 m = 8 atm and pressure at 100 m = 11 atm, 11 ÷ 8 = 1.375 = 1.38*	**(1)**

Question number	Animals that dive need to store more oxygen than animals that do not dive. Oxygen can be stored in muscle, in the blood and in the respiratory system. A dolphin stores 40% of its oxygen in muscle, 33% in blood and 27% in its respiratory system. Calculate the ratio of oxygen stored in muscle : blood : respiratory system. **Answer**	**Additional guidance**	**Mark**
6(b)(i)	• 1.5 : 1.2 : 1.0 (1)		**(1)**

Question number		Additional guidance	Mark
	Muscle stores oxygen attached to a molecule called myoglobin. The diagrams show a molecule of myoglobin and a molecule of haemoglobin.  The graph shows the oxygen dissociation curves for myoglobin and haemoglobin. Explain why the shapes of these oxygen dissociation curves are different. Use the information in the diagrams and your own knowledge to support your answer. **Answer**		

6(b)(ii)	An explanation that includes the following points: • haemoglobin is an S-shape curve and myoglobin is {not / hyperbolic} / Haemoglobin has 4 { subunits / haem groups } Myoglobin has {1 subunit / haem group} (1) • Myoglobin has a higher affinity for Oxygen than Hb (1) • myoglobin has one {subunit / haem group} so the oxygen is either attached or not (1) • haemoglobin has four {subunits / haem groups} so {not all oxygens are released at the same time / staggered release} (1)		**(3)**

Question number		Mark
	Scientists studied the blood of three species of diving seal found in the Arctic Ocean. The scientists took blood samples from 3 bearded seals, 31 ribbon seals and 29 spotted seals. They determined the percentage volume of red blood cells in the blood and the mean haemoglobin concentration per red blood cell (MHCC). The graphs show some of the results of this study.  **b** In a human, the percentage volume of red blood cells ranges from 40% to 45% and the MHCC ranges from 320 g dm^{-3} to 360 g dm^{-3}. Explain the differences in the data for humans and these diving seals and comment on the extent to which valid conclusions can be drawn from this data. **Answer**	

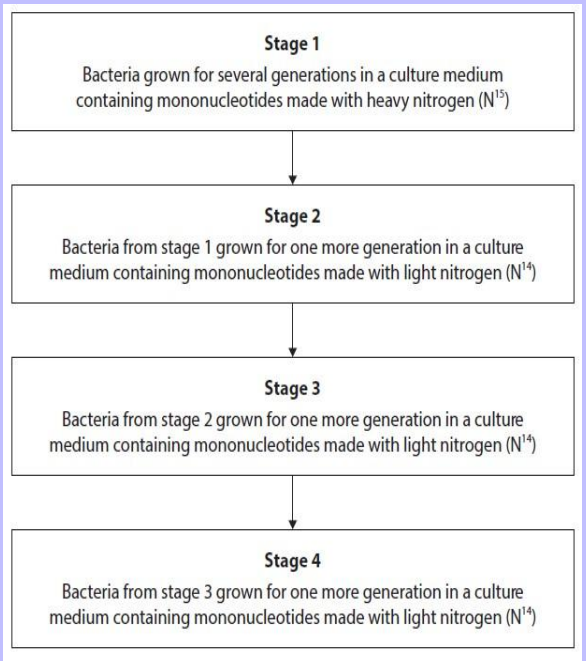
***6(c)**	Indicative content: Graph 1 - %RBC Ribbon seals have highest % of red blood cells There is overlap between Ribbon seals and spotted seals making data not significant Bearded seals have the lowest % of red blood cells Bearded seals and Spotted seals error bars overlap making data not significant Graph 2 – MHCC Bearded seals have highest content of MHCC Ribbon and Spotted seals have approx. same content of MHCC Graph 3 - % RBC and Sex There is no difference between the red blood cell % of males and females as error bars overlap within the species No data for female bearded seals Male ribbon seals have highest % RBC Graph 4 – MHCC and Sex Male bearded seals have the highest content of MHCC No data for female bearded seals Female ribbon and spotted seals have the same content of MHCC Human comparison • Humans have fewer RBC • Humans have similar MHCC to ribbon and spotted seals 	**(6)**

	Validity Comments • error bars linked to a valid conclusion drawn • sample size small, especially for bearded seals, so conclusions cannot be made • no females in bearded seal group so conclusions on sex comparison are not valid. • Lack of information on other variables {affect / decreases} validity of conclusions. Explanations • red blood cells bind oxygen in lungs and release it to cells • haemoglobin binds to the oxygen inside the RBCs as it has high affinity for oxygen • oxygen released in tissues as haemoglobin has a higher affinity to carbon dioxide • seals cannot breathe under water when they are diving • therefore they need to carry more oxygen for aerobic respiration while diving • Humans have fewer RBC as they done need to go long periods without breathing • Humans have similar MHCC to ribbon and spotted seals as they still need to carry oxygen around the body • Higher MHCC means more haem groups to carry more oxygen • some of the seals have similar MHCC to humans but there are more RBCs therefore more haemoglobin overall • bearded seal has more MHCC but this may compensate for lower % RBC • different species of seal may have different energy requirements and therefore oxygen requirements because they may dive for longer / may be different sizes	

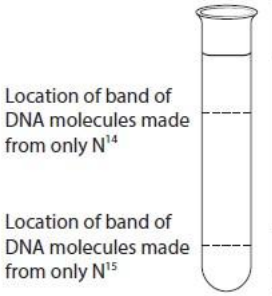
			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.	Simple descriptions of data 1 mark = descriptions from one graph or one relevant comment 2 marks = descriptions from three graphs or 2 graphs and a comparison to humans
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.	Simple explanations with some consideration of validity 3 marks = 1 simple explanation **OR** descriptions of 3 graphs and a comment on error bars OR descriptions of 2 graphs, a comparison and a comment on error bars / validity 4 marks = simple explanation PLUS a comment on error bars / validity
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.	Full evaluation of results and study design 5 marks = 2 explanations for either differences between seals and humans OR different seals AND a comment on validity of conclusions 6 marks = an explanation for 1 difference between seals and humans AND 1 difference between different seals AND a comment on validity of conclusion

Question number	The diagram shows a DNA molecule twisted into a double helix. Each DNA molecule is made of two DNA strands. Each strand is made from mononucleotides.  Name the three types of component that make up a **DNA** mononucleotide. **Answer**	**Additional guidance**	**Mark**
7(a)(i)	An answer that includes the following points: • (nitrogenous) base • deoxyribose / pentose (sugar) • phosphate (2)	1 mark = 1 or 2 correct 2 marks = all 3 correct **ALLOW** A, G, T, C or named bases if all listed **DO NOT ACCEPT** Ribose **DO NOT ACCEPT** phosporus **ALLOW** PO_4^{3-} **DO NOT ALLOW** PO_3^{2-}	**(2)**

Question number	Bonds hold the components of mononucleotides together and other bonds hold the mononucleotides together to form a double helix. Describe the role of the different types of bonds in a DNA double helix. **Answer**	**Additional guidance**	**Mark**
7(a)(ii)	A description that includes four of the following points: • hydrogen bonds ensure <u>complementary</u> base pairing (1) • hydrogen bonds to hold {the two strands together / bases on opposite strands together } (1) • hydrogen bonds to hold the (double) helix in shape (1) • phosphodiester bonds to join adjacent mononucleotides together (in a DNA strand) (1) • covalent bonds to attach the bases to the sugar (1) • covalent bonds to attach the elements together in {a base / a sugar} (1)	Penalise reference to Ribose once **ALLOW** examples of complimentary base pairing with number of bonds e.g. A and T and G and C **DO NOT ACCEPT** if the numbers of H-bonds are incorrect. **ALLOW** to join 2 deoxyribose together (with a phosphate group)	**(4)**

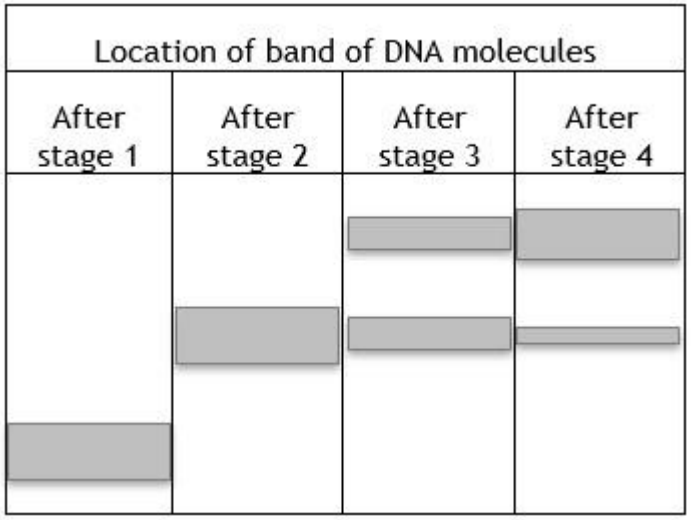
Question number		Additional guidance	Mark
	Meselson and Stahl provided data that supported the theory of the semi-conservative replication of DNA. Meselson and Stahl used mononucleotides made with either heavy nitrogen (N^{15}) or light nitrogen (N^{14}) in their experiments. The flowchart summarises part of one of their experiment  After each stage, a sample of the culture was taken. Each sample was the same volume. The DNA was removed from the bacteria and the DNA molecules separated on a density gradient in a tube. Complete the diagram in the answer book to show: • the change in location of the bands of DNA molecules in each sample for stages 2, 3 and 4 • the proportion of each type of DNA molecule at each location.		

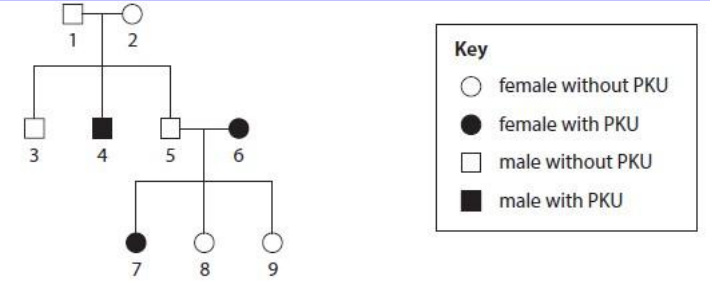
Stage 1 has been completed for you.



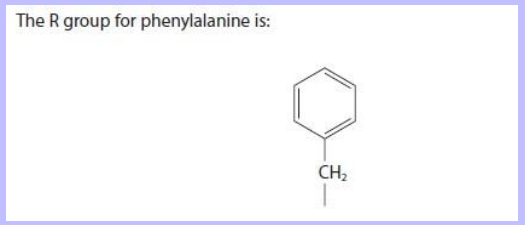
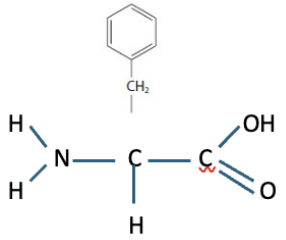
Location of band of DNA molecules			
After stage 1	After stage 2	After stage 3	After stage 4

Answer

7(b)	An answer that includes the following points: Stage 2 shows • one band about halfway up (1) • band is same width as that at stage 1 (1) Stage 3 shows • two bands in correct positions (as stage 2 plus one above) (1) • both bands are smaller than the width of stage 2 (1) Stage 4 shows • two bands at correct positions (same positions as stage 3) (1) • top band is wider than stage 3 and bottom band is narrower (1)		**(6)**

Question number	Phenylketonuria (PKU) is a genetic disorder. An individual with this disorder has a homozygous recessive genotype. The pedigree diagram shows some individuals, numbered 1 to 9, in one family.  Explain why individuals 1 and 2 are heterozygous for PKU. **Answer**	**Additional guidance**	**Mark**
8(a)(i)	An explanation that includes the following points: • Individuals 1 and 2 must be {carriers / has 1 recessive and 1 dominant allele / Pp} as neither have PKU • Individual 4 has PKU so must have inherited the PKU allele / p from each parent	**DO NOT ACCEPT** gene for allele **ACCEPT** <u>mutated</u> gene	**(2)**

Question number	Determine the probability that the next child of individuals 5 and 6 will have PKU. The genotype of individual 5 is Pp and the genotype of individual 6 is pp. Use a genetic diagram to support your answer. **Answer**	**Additional guidance**	**Mark**
8(a)(ii)	An answer that includes the following points: • correct genetic diagram that shows the offspring as equal numbers of Pp and pp (1) • Probability Given as {50:50/ 1:1 / half / 50% / 0.5 / ½ / 1 in 2} (1)	NB no marks if X and Y used as genotypes **Accept** 2 in 4	**(2)**

Question number	Phenylalanine is an amino acid found in some foods. When phenylalanine is consumed, it can be broken down into another amino acid called tyrosine. Enzyme P catalyses this reaction. Individuals with PKU have a mutation in the gene coding for enzyme P. Phenylalanine builds up, causing this disorder, and can also lead to a deficiency of tyrosine in the body. Draw a diagram in the answer book to show the structure of the amino acid phenylalanine. The R group for phenylalanine is:  **Answer**	**Additional guidance**	**Mark**
8(b)(i)	An answer that includes the following points: • central carbon (attached to CH_2) with an H attached (1) • COOH / COO^- group attached (1) • NH_2 / NH_3+ attached (1)	**ALLOW** R instead of ring If R group drawn incorrectly do not allow mp1  	**(3)**

Question number	Explain how a mutation in the gene coding for enzyme P could result in a build up of phenylalanine in the body. **Answer**	**Additional guidance**	**Mark**
8(b)(ii)	An explanation that includes the following points: • because a mutation (in the gene) would change the base sequence (1) • therefore the (m)RNA will have different codons (1) • and a different sequence of amino acids will be <u>translated</u> (1) • therefore; the protein {will not fold correctly / will form different bonds / will have different interactions} (1) • and the <u>active site</u> will be the wrong shape so the enzyme will not bind to the phenylalanine (converting it to tyrosine) (1)	**ACCEPT** description e.g. one base is swapped with another **DO NOT ACCEPT** transcription **ACCEPT** ESC will not form provided it is related to enzyme	**(4)**

Question number	Suggest two reasons why controlling diet can help an individual with PKU. **Answer**	**Additional guidance**	**Mark**
8(b)(iii)	An answer that includes the following points: • reduce the dietary intake of phenylalanine so that there is not an excess (1) • increase the intake of dietary tyrosine so that there is enough for the demands of the body (1)	**ACCEPT** accumulation / build up / too much as excess **ACCEPT** prevents a deficiency of tyrosine	**(2)**