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June 2024

GCE Biology B 9BI0 02

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June 2024

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Introduction

The examiners were impressed with the high standard of many of the scripts seen. Many candidates had clearly worked very hard to prepare for these examinations and both centres and candidates should be commended for their hard work. Many candidates demonstrated excellent factual knowledge of most areas of the specification and often used scientific vocabulary accurately and confidently. Most candidates understood the demands of each of the command words although a small number confused 'explain' with 'describe'. Maths skills were very good with most understanding how to rearrange formulae, use significant figures and standard form. It was pleasing to see that most candidates tackled both the six mark, level-based questions confidently and understood the need to explore the data fully. Some candidates still lack confidence when tackling data analysis questions using unfamiliar data. When analysing data, candidates should always state all the patterns, suggest explanations and consider the validity of the experimental design.

A few candidates tended to underestimate the level of detail required at A-level. This was particularly evident in Question 2(a)(i) where many candidates only gave the most basic descriptions of plant reproduction rather than explaining how the haploid nuclei are formed in the embryo sac. Most candidates attempted all the questions and it is clear that many have worked hard on examination technique to focus answers on the number of mark points allocated, rather than filling all the available lines.

Question 1 (b)

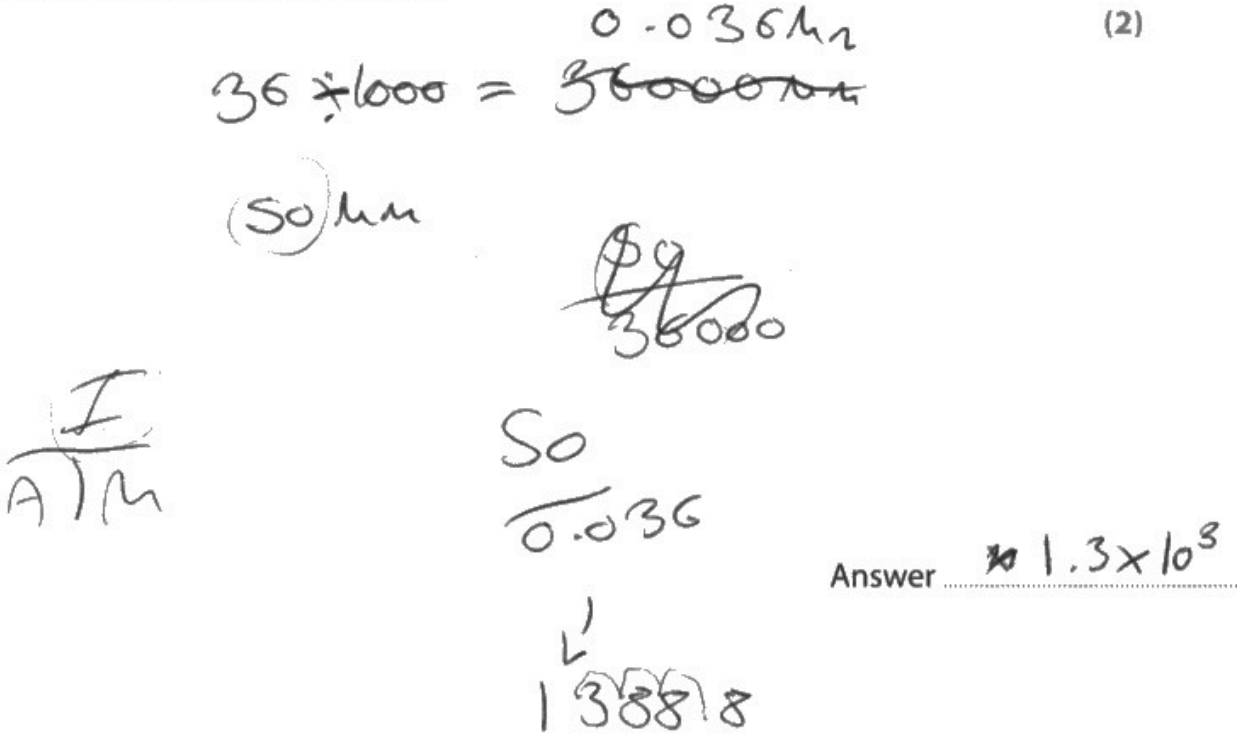
This question required candidates to calculate a magnification. Most candidates were able to gain at least one mark by correctly calculating the magnification and many went on to give their answer in standard form. A few candidates did not gain the second mark as they did not give their answer in the correct standard form. Some candidates did not convert the units of measurement correctly – it is good practice to measure in millimetres rather than centimetres as this makes the unit conversions more straightforward.

(b) The width of structure P, measured between X and Y, is 36 μm.

Calculate the magnification of this photograph.

Give your answer in **standard form**.

(2)



ResultsPlus
Examiner Comments

This answer gained 1 mark

The candidate obtained the correct answer in the working, but used the wrong standard form.

ResultsPlus
Examiner Tip

Always show all your working clearly.

(b) The width of structure P, measured between X and Y, is 36 μm.

Calculate the magnification of this photograph.

Give your answer in **standard form**.

(2)

X → Y = 5cm = 50 mm = 50,000 μm

50,000 / 36 = ~~1388.8~~ x

1388.8

$1.3\dot{8} \times 10^3$

1.39×10^3

Answer ~~$1.3\dot{8} \times 10^3$~~

ResultsPlus
Examiner Comments

This answer gained both marks.

The candidate has calculated the magnification correctly and gone on to use the correct standard form.

Question 1 (c)

This question was well answered by many candidates with most gaining at least one mark and many gaining both. The question asked candidates to explain why it was important to keep the enzyme and substrate in separate compartments. Many recognised that this prevented the formation of E-S complexes which would also prevent the release of cyanide and the death of the cells. Many also correctly stated that it would mean that the cyanide is only released if the cell is damaged. Some candidates correctly stated that there would be no E-S complexes (or equivalent) but did not go on to say that this would prevent the death of the cells.

(c) Some plants have adaptations that prevent them being eaten by animals.

Sorghum is a plant that stores a substance called dhurrin inside leaf cells in the structures labelled S in the photograph.

Dhurrin is broken down by the enzyme glucosidase to release hydrogen cyanide.

Glucosidase is stored within the chloroplasts of leaf cells.

Hydrogen cyanide inhibits aerobic respiration.

Explain why dhurrin is stored within structure S, and glucosidase is stored separately in the chloroplasts.

(2) 1

vacuoles store nutrient for plants to grow so when if glucosidase is with dhurrin all Dhurrin will be broken down to release hydrogen cyanide and cell will not be turgid for structure. Hydrogen cyanide inhibits aerobic respiration so less ATP is produce for active processes.

(Total for Question 1 = 7 marks)

ResultsPlus
Examiner Comments

This answer gained 1 mark for the idea of preventing the release of the cyanide.

Prevention of aerobic respiration was in the early parts of the question so was not awarded a mark – if the candidate had gone on to say that this would kill the cell or plant, a second mark would have been awarded.

(c) Some plants have adaptations that prevent them being eaten by animals.

Sorghum is a plant that stores a substance called dhurrin inside leaf cells in the structures labelled S in the photograph.

Dhurrin is broken down by the enzyme glucosidase to release hydrogen cyanide.

Glucosidase is stored within the chloroplasts of leaf cells.

Hydrogen cyanide inhibits aerobic respiration.

Explain why dhurrin is stored within structure S, and glucosidase is stored separately in the chloroplasts.

(2)

• Both S and chloroplasts are bound membrane so prevents ~~Bt~~ dhurrin and glucosidase from ~~at~~reacting together to make hydrogen cyanide

• If hydrogen cyanide is made it will inhibit aerobic respiration, killing the plant

• Dhurrin and glucosidase need to be stored in seperate membrane bound organelles to prevent them from binding/forming an enzyme substrate complex and reacting and entering the mitochondria to inhibit aerobic respiration

(Total for Question 1 = 7 marks)

ResultsPlus
Examiner Comments

This is a good answer that gained both marks. The candidate clearly states that cyanide is not produced and that this would kill the plant.

(c) Some plants have adaptations that prevent them being eaten by animals.

Sorghum is a plant that stores a substance called dhurrin inside leaf cells in the structures labelled S in the photograph.

Dhurrin is broken down by the enzyme glucosidase to release hydrogen cyanide.

Glucosidase is stored within the chloroplasts of leaf cells.

Hydrogen cyanide inhibits aerobic respiration.

Explain why dhurrin is stored within structure S, and glucosidase is stored separately in the chloroplasts.

(2)

So that the ~~enzyme glucosidase can~~ dhurrin substrate cannot bind to the enzyme, glucosidase's, active site and produce the enzyme substrate complex: hydrogen cyanide. This inhibits aerobic respiration so the plant will not be able to produce ATP for active transport to survive

ResultsPlus
Examiner Comments

This answer gained both marks.

The candidate clearly gains mark points one and three – by referring to the formation of E-S complexes, the candidate uses excellent scientific vocabulary.

ResultsPlus
Examiner Tip

Always use accurate, detailed scientific vocabulary.

Question 2 (a)(i)

This question generated a very variable range of responses. Some outstanding answers were seen that described the process of meiosis, the disintegration of three nuclei and the subsequent three rounds of mitosis to produce eight haploid nuclei. Many confused answers were also seen with some candidates describing oogenesis or spermatogenesis. Common errors included: confusing meiosis and mitosis, referring to haploid cells rather than haploid nuclei, referring to polar bodies rather than polar nuclei, and describing the double fertilisation rather than the production of the embryo sac. It is very important that candidates use technical terms accurately.

2 The photograph shows tomato flowers.

(Source: © NIGEL CATTLIN / HOLT STUDIOS / SCIENCE PHOTO LIBRARY)

(a) (i) Describe how an embryo sac, containing eight haploid nuclei, is formed inside the ovary of a flower.

(3)

The ovary is formed by megasporogenesis. Firstly the megaspore mother cell divides by mitosis twice to form four diploid megaspores. These then divide by meiosis to produce the eight haploid nuclei. There ~~are~~ is the one gamete/ ovule and then ~~3 2 synergids, 2 polar bodies and two~~ two polar bodies, three synergids and two polar nuclei. The ~~an~~ ovule/haploid gamete is fertilised to make the diploid nuclei and the polar bodies form the triploid endosperm which ~~makes~~ is a food store.

ResultsPlus
Examiner Comments

This answer gained no marks.

The candidate has confused the order of mitosis and meiosis.
Although there are many technical terms used, the context for them is incorrect.

ResultsPlus
Examiner Tip

Make sure that you use technical terms accurately.

2 The photograph shows tomato flowers.

(Source: © NIGEL CATTLIN / HOLT STUDIOS / SCIENCE PHOTO LIBRARY)

(a) (i) Describe how an embryo sac, containing eight haploid nuclei, is formed inside the ovary of a flower.

(3)

An embryo sac is formed by meiosis of megaspore to form ~~pri~~ primary ooña and a polar body and then a second round of division forms secondary ooña and 3 polar bodies. The polar bodies degenerate and are absorbed to form the embryo sac. ~~Contains 8 nuc~~ 3 rounds of mitotic division occurs.

ResultsPlus
Examiner Comments

This answer gained 1 mark for stating that there are three rounds of mitosis.

No credit was awarded for the reference to meiosis as there is no production of four haploid nuclei or megaspores.

2 The photograph shows tomato flowers.

(Source: © NIGEL CATTLIN / HOLT STUDIOS / SCIENCE PHOTO LIBRARY)

(a) (i) Describe how an embryo sac, containing eight haploid nuclei, is formed inside the ovary of a flower.

(3)

first a diploid mother megaspore divides via mitosis to form 4, haploid diploid megaspores. One megaspore will disintegrate and the three surviving megaspores will divide via meiosis 3 times to form eight haploid nuclei, 1 egg cell, 2 polar nuclei, 3 antipodal, 2 synergerd.

ResultsPlus
Examiner Comments

This answer gained no marks.

There are many references to meiosis and mitosis, but the context is incorrect.

2 The photograph shows tomato flowers.

(Source: © NIGEL CATTLIN / HOLT STUDIOS / SCIENCE PHOTO LIBRARY)

(a) (i) Describe how an embryo sac, containing eight haploid nuclei, is formed inside the ovary of a flower.

(3)

• Mother Megaspore undergoes meiosis to produce 4 megaspores.

• 3 out of the 4 megaspores disintegrate and the 1 that survives divides 3 times to produce 8 cells. 1 egg, 3 antipod 2 synergid + 2 polar nuclei.

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 3 marks.

The candidate states that meiosis produces the four megaspores and that three disintegrate, whilst one undergoes three rounds of mitosis.

Question 2 (c)(ii)

This question assessed candidates' understanding of genetic crosses. Many candidates were able to correctly ascertain the parental genotypes, draw a Punnett square and determine the final ratios. Some candidates tried to guess the genotypes and simply stated (incorrectly) that a 9:3:3:1 ratio would be produced. Some candidates incorrectly tried to draw two separate crosses for each gene rather than a dihybrid cross. Candidates should also be clear as to what their ratios represent – for mark point four to be awarded, it needed to be clear that the ratio represented 4 red:3 yellow:1 white.

(ii) A tomato breeder crosses a yellow tomato plant with a red tomato plant that is heterozygous for both genes.

Some of the F1 generation tomatoes are white.

Determine the expected ratios of all the phenotypes of the F1 generation, using a genetic diagram.

(4)

Yellow : rrTt

Red : RrTt

	rT	rt	rT	rt
RT	RrTT	RrTt	RrTT	RrTt
Rt	RrTt	Rrtt	RrTt	Rrtt
rT	rrTT	rrTt	rrTT	rrTt
rt	rrTt	rrtt	rrTt	rrtt

✓ ✓ ✓

Phenotypes :

Red - RrTT, RrTt, ~~RrTT, RrTt~~, Rrtt ✓✓✓✓✓✓✓

White flesh, yellow skin- rrTT, rrTt, ✓✓✓✓✓

White flesh, white skin- rrtt ✓✓

Red : White, yellow, White, white

~~8:4~~:

8 : 6 : 2

4 : 3 : 1

Answer 4 : 3 : 1

ResultsPlus
Examiner Comments

This answer gained 3 marks.

The parental genotypes, gametes and offspring genotypes are clear. It is not clear what the 4:3:1 ratio links to in terms of phenotypes.

(ii) A tomato breeder crosses a yellow tomato plant with a red tomato plant that is heterozygous for both genes.

Some of the F1 generation tomatoes are white.

Determine the expected ratios of all the phenotypes of the F1 generation, using a genetic diagram.

(4)

X

Yellow plant = rrTT

rT, rT, rT, rT

red = RrTt

RT, Rt, rT, ~~Rt~~ rt

	RT	Rt	rT	rt
rT	RrTT	RrTt	rrTT	rrTt

← no white yellow ~~and green~~ incorrect

Yellow = rrTt

rT, rt, rT, rt

red = RrTt

RT, Rt, rT, rt

	RT	Rt	rT	rt
rT	RrTT red	RrTt red	rrTT yellow	rrTt y
rt	RrTt red	Rrtt red	rrTT yellow	rrtt w

4 red

3 yellow

1 white

Answer 4:3:1

ResultsPlus
Examiner Comments

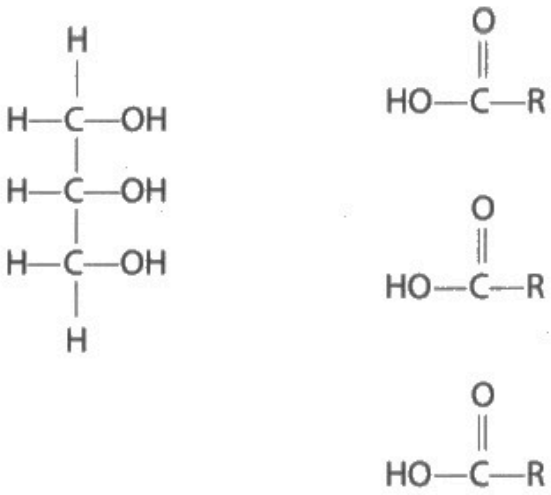
This is an excellent answer that gained all 4 marks – it is clear that the 4:3:1 represents red, yellow and white.

Question 3 (a)(i)

This straightforward question asked candidates to draw a triglyceride. Most candidates were able to correctly draw ester bonds, but a few did not include an oxygen between the glycerol and fatty acids.

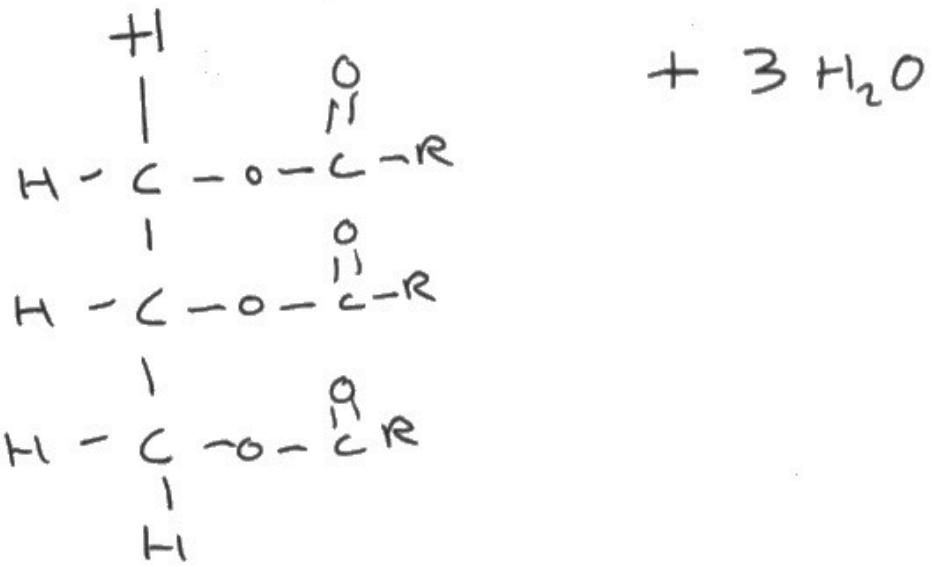
3 Fats and oils are lipids synthesised from glycerol and fatty acids.

(a) The diagram shows the structures of glycerol and three fatty acids.



(i) Draw the **triglyceride** that would be produced from these molecules.

(1)

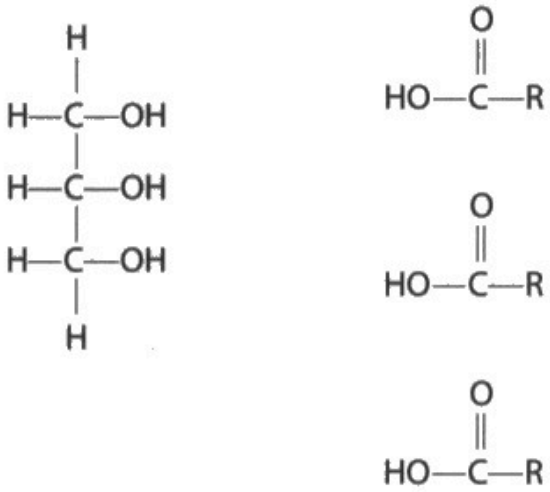


ResultsPlus
Examiner Comments

This is a correct answer that gained the mark.

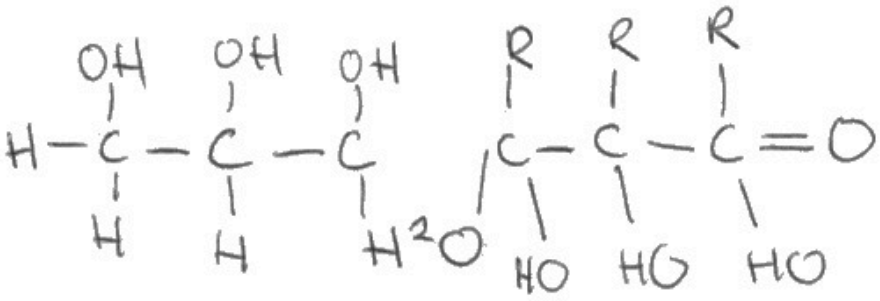
3 Fats and oils are lipids synthesised from glycerol and fatty acids.

(a) The diagram shows the structures of glycerol and three fatty acids.



(i) Draw the **triglyceride** that would be produced from these molecules.

(1)



ResultsPlus
Examiner Comments

This is an example of an incorrect answer that did not gain any credit. The candidate has joined the three fatty acids together.

Question 3 (b)(i)

Most candidates were able to correctly calculate the mass of oleic acid as 19g and give the answer to two significant figures. A few candidates gave the wrong number of significant figures.

Question 3 (b)(ii)

This question required candidates to give one similarity and one difference between saturated and unsaturated fatty acids. Many candidates gained at least one mark. Most were able to correctly give a similarity such as the possession of the same elements of carbon, hydrogen, and oxygen. Many also gave a correct difference, the most common being the possession of C=C bonds in unsaturated fatty acids. Candidates should be careful to give accurate descriptions – a significant number of candidates simply referred to 'double bonds' rather than specifically 'carbon-carbon double bonds'.

(ii) Give **one** similarity and **one** difference between the structure of a **saturated** fatty acid and an **unsaturated** fatty acid.

(2)

Similarity

Both contain carbon ~~atoms~~, hydrogen and oxygen atoms

Difference

Unsaturated fatty acid carbon chain contains C=C double bonds ~~as it is bonded~~, saturated only contains C-C single bonds ~~as it is straight chained~~

ResultsPlus
Examiner Comments

This is a strong answer that gained both marks.

The candidate correctly gives a similarity of C,H and O being present and correctly refers to the difference in C=C bonds.

(ii) Give **one** similarity and **one** difference between the structure of a **saturated** fatty acid and an **unsaturated** fatty acid.

(2)

Similarity

both contain COOH / carboxyl group

Difference

unsaturated contains C=C (carbon & carbon double bonds)

ResultsPlus
Examiner Comments

This answer gained both marks – the presence of COOH in both is correct and the stated difference is also correct.

(ii) Give **one** similarity and **one** difference between the structure of a **saturated** fatty acid and an **unsaturated** fatty acid.

(2)

Similarity

both contain a Carbon chain

Difference

Saturated Contains a Carbon & Carbon double bond

whereas an unsaturated fatty acid doesn't

ResultsPlus
Examiner Comments

This answer gained no marks.

The idea of carbon chain is too vague for a similarity and the candidate has confused saturated and unsaturated fatty acids for the difference.

Question 3 (b)(iii)

This question was well answered with many candidates gaining at least one mark and many going on to gain a second. Fewer went on to gain all three marks. Many candidates commented on the data by making relevant comments about the different fatty acid contents of the different lipids and it was pleasing to see how many candidates were able to identify which fatty acids were saturated and unsaturated. Strong answers went on to link the consumption of saturated fatty acids with heart disease and other health issues. 'Comment on' questions require candidates to identify all the patterns in data and also suggest explanations for data.

(iii) Analyse the data to comment on which of these lipids are healthier to eat.

(3)

1) Cocoa butter is the healthiest ~~Oleic acid is the healthiest to eat~~ to eat as it has the most even distribution of each fatty acid percentage of, as it also has ~~only~~ ~~high~~ the highest levels of saturated fatty acids* (30% and 36%) and low levels of unsaturated fatty acids like linoleic acid and linolenic acid. ~~the~~ Linolenic and linoleic acid are unsaturated fatty acids due to their structure of 18 carbons but only 32 hydrogens in linoleic acid and 30 hydrogens in linolenic acids, therefore they have more double bonds between their carbons and so are more unsaturated. more HdLs. Stearic acid are the most saturated and palmatic acid fatty acids whilst oleic acid has one c=c bond.

*30% palmatic acid and 36% stearic acid

Unsaturated fatty acids are unhealthy because they produce high density lipopolysaccharides which increase cholesterol levels in the blood, increasing risk of atherosclerosis.

2) Almond oil has a high percentage of oleic acid, which is not the most healthy fatty acid due to its double bond.

3) Flax seed oil is the least healthy as it has low percentages of ~~fatt~~ saturated fatty acids and high percentages of unsaturated fatty acids.

(Total for Question 3 = 8 marks)

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Examiner Comments

This is an excellent answer that gained all 3 marks.

The candidate has compared the proportions of the fatty acids in the lipids and identified specific unsaturated and saturated fatty acids. Later in the answer, the candidate links the data to atherosclerosis.

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Examiner Tip

Think about 'comment on' questions as if they are 'describe and explain'.

(iii) Analyse the data to comment on which of these lipids are healthier to eat. **(3)**

- flaxseed oil has a very high proportion of linolenic acid, but almond oil & cocoa butter have no linolenic acid
- palmitic & stearic acid is ~~a~~ saturated fatty acid whereas the other are ~~unsat~~ unsaturated fatty acid
- oleic acid is ~~monounsatu~~ monounsaturated but linoleic ~~ac~~ & linolenic acid is ~~polyun~~ polyunsaturated
- ~~coco~~ cocoa butter has highest ~~pro~~ proportion of palmitic & stearic acid so is unhealthiest as saturated fats are unhealthier
- almond oil has highest proportion of oleic acid so is healthiest as monounsaturated fats are healthiest
- flaxseed is healthier than cocoa butter because ~~it ha~~ flaxseed has less saturated fat.

(Total for Question 3 = 8 marks)

ResultsPlus
Examiner Comments

This answer gained 2 marks for identifying patterns in the fatty acid compositions and identifying specific saturated fatty acids.

Sat. F.A = Solid, regular unsat. F.A = irregular, liquid.

(iii) Analyse the data to comment on which of these lipids are healthier to eat.

(3)

As cocoa butter is a solid and the other two are oils. The oils are healthier as they have double bonds due to the unsaturated fatty acids. They have an irregular arrangement. Between flaxseed and almond, Flaxseed is healthier as it has the percentage present of the fatty acids values more similar in range than Almond oil

ResultsPlus
Examiner Comments

This answer gained no marks.

There is no description of any of the data patterns and no identification of specific saturated or unsaturated fatty acids.

Question 4 (a)

This question generated many excellent answers that attained at least two marks. Strong answers focused on the command word, 'explain' and gave reasons for specific features of alveoli. Weaker answers tended to identify features of alveoli but did not link them to reasons for maximal gas exchange. Candidates should be careful to give precise answers – 'single cell thick wall to speed up exchange' would not gain a mark, however, 'single cell thick wall to minimise the diffusion pathway' would gain a mark. Candidates should also be careful not to use incorrect terminology – several references to thin cell walls were seen – this is an incorrect statement.

4 Asthma is a condition that causes bronchi (airways) in the lungs to narrow.

Salbutamol is a drug that is often used to treat asthma.

Salbutamol causes muscles to relax to widen the bronchi.

Salbutamol acts by binding to the adrenaline receptors of cells.

(a) Gas exchange in the lungs occurs at the alveoli.

Explain how alveoli are adapted to maximise gas exchange.

(3)

alveoli is very sponge like huge surface area to maximise diffusion. SA :volume ratio is huge very large SA.
alveoli contains high blood supply, many capillaries, meaning very short diffusion pathway for O_2 to travel and oxygenate blood. through epithelial cells in capillary.

ResultsPlus
Examiner Comments

This answer gained no marks.

The reference to surface area is not linked to many alveoli and the capillaries are not linked to maintenance of a diffusion gradient.

4 Asthma is a condition that causes bronchi (airways) in the lungs to narrow.

Salbutamol is a drug that is often used to treat asthma.

Salbutamol causes muscles to relax to widen the bronchi.

Salbutamol acts by binding to the adrenaline receptors of cells.

(a) Gas exchange in the lungs occurs at the alveoli.

Explain how alveoli are adapted to maximise gas exchange.

(3)

There is a large number of alveoli in the lung with a large surface to volume ratio. Alveoli has a very short diffusion distance (1 cell). These make the movements of oxygen and carbon dioxide down the concentration gradient more effective (with a faster rate)

ResultsPlus
Examiner Comments

This answer gained 1 mark for the idea of a short diffusion distance.
The large surface area is not linked to rapid diffusion.

4 Asthma is a condition that causes bronchi (airways) in the lungs to narrow.

Salbutamol is a drug that is often used to treat asthma.

Salbutamol causes muscles to relax to widen the bronchi.

Salbutamol acts by binding to the adrenaline receptors of cells.

(a) Gas exchange in the lungs occurs at the alveoli.

Explain how alveoli are adapted to maximise gas exchange.

(3)

- They have good blood supply, maintains steep O_2 concentration gradient.
- They have one cell thick wall, shortens diffusion distance of gases.
- Theres a great number of alveoli, a large surface area to maximise rate of diffusion.
- They have moist surface, gases can dissolve, provide faster diffusion.

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 3 marks.

The candidate has explained three adaptations. The structure of the answer is an example of good practice – clear link for each adaptation with a reason.

4 Asthma is a condition that causes bronchi (airways) in the lungs to narrow.

Salbutamol is a drug that is often used to treat asthma.

Salbutamol causes muscles to relax to widen the bronchi.

Salbutamol acts by binding to the adrenaline receptors of cells.

(a) Gas exchange in the lungs occurs at the alveoli.

Explain how alveoli are adapted to maximise gas exchange.

(3)

The alveoli have a very thin wall / endothelial cells. This reduces the diffusion distance, increasing rate of diffusion. There are many alveoli so this gives a large surface area. The alveoli are moist so O_2 and CO_2 dissolve / easily diffuse. good concentration gradient maintained as lots of capillaries carry blood nearby. Ficks law applies and shows how alveoli adaptations maximise diffusion rate and gas exchange.

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Examiner Comments

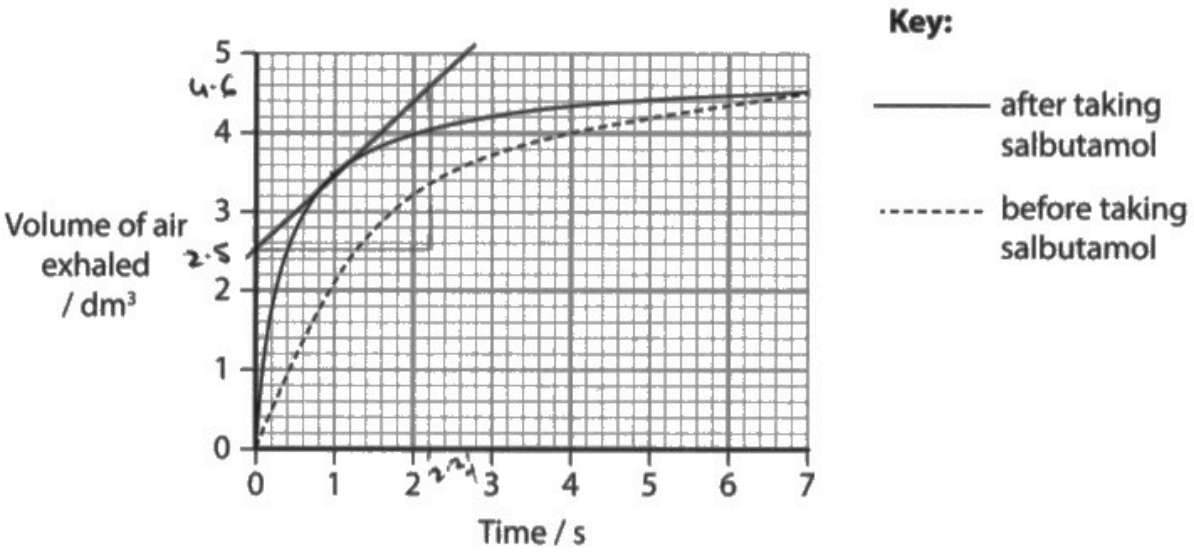
This strong answer gained all 3 marks.

The candidate correctly links the think wall to a short diffusion path, the moist alveoli to the dissolving of gases, and the capillaries maintaining a diffusion gradient.

Question 4 (c)(i)

This question required candidates to use a tangent to a curve to measure the rate of exhalation at one second. To gain both marks, candidates had to have a correct tangent and answer. Many candidates were able to gain both marks. A number of candidates did not draw correct tangents and others were unsure how to calculate the gradient.

(c) The graph shows the volumes of air breathed out by a person with asthma before taking salbutamol and after taking salbutamol.



(i) Determine the rate of exhalation of air at **one second** after taking salbutamol.

Use a tangent to the curve.

$4.6 - 2.5 = 2.1\ dm^3$ (2)

$2.1 / 2.2s = 0.954$

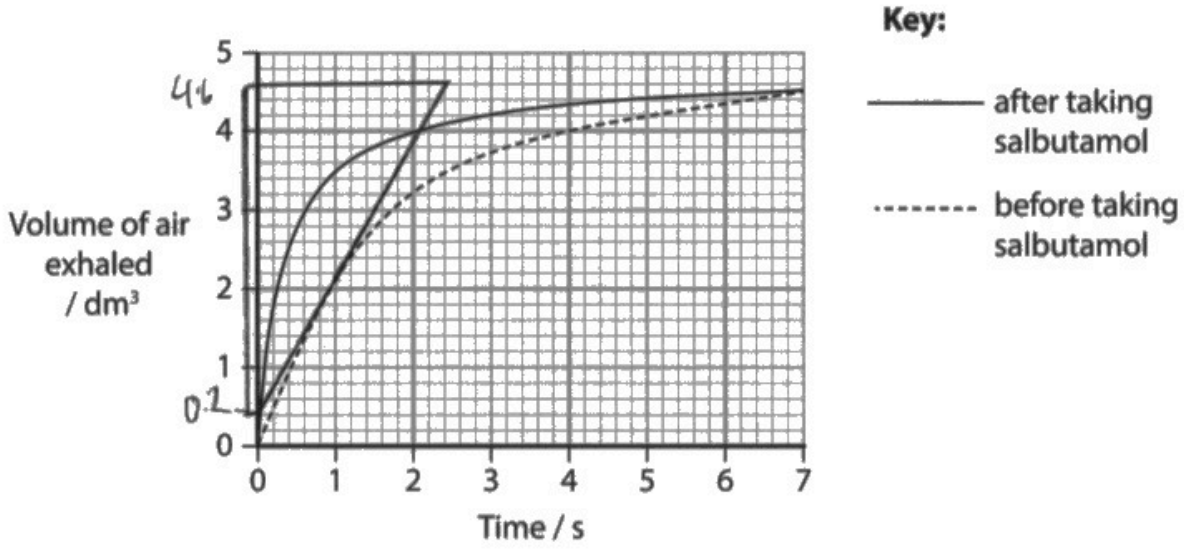
$= 0.95$

Answer 0·95 dm^3 per second

ResultsPlus Examiner Comments

This answer gained 1 mark as an error carried forward for the gradient to the tangent that is in the correct place.

(c) The graph shows the volumes of air breathed out by a person with asthma before taking salbutamol and after taking salbutamol.



(i) Determine the rate of exhalation of air at **one second** after taking salbutamol.

Use a tangent to the curve.

(2)

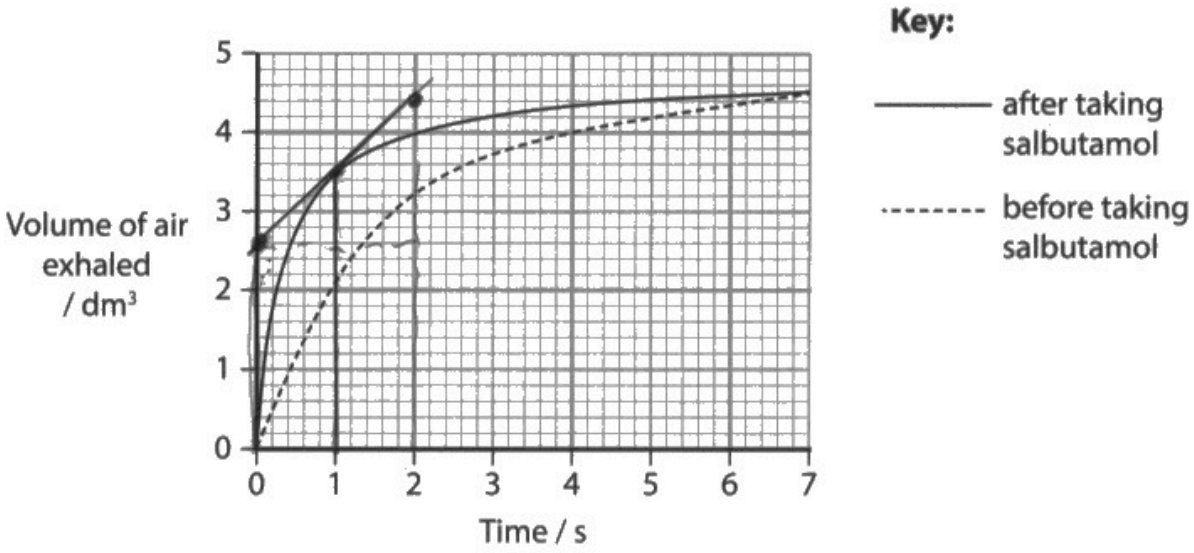
$\frac{4.4}{2.6} = 1.7$

Answer 1.7 dm³ per second

ResultsPlus
Examiner Comments

This answer gained no marks as the tangent is incorrect.

(c) The graph shows the volumes of air breathed out by a person with asthma before taking salbutamol and after taking salbutamol.



(i) Determine the rate of exhalation of air at **one second** after taking salbutamol.

Use a tangent to the curve.

$\frac{\Delta y}{\Delta x} = \frac{4.4 - 2.6}{2 - 0} = 0.9 \text{ dm}^3/\text{s}$ (2)

Answer 0.9 dm³ per second

ResultsPlus
Examiner Comments

This answer gained 2 marks for a correct tangent and a correct calculation of the gradient.

Question 4 (c)(ii)

This question required candidates to analyse the graph to explain why taking salbutamol increases the concentration of oxygen in the blood. Many candidates correctly recognised that the rate of exhalation or inhalation is higher or that more air can be breathed in. Strong answers went on to explain that taking salbutamol means that the concentration gradient between alveoli and blood is maintained so that the rate of diffusion into the blood is high. To gain the third point, candidates needed to refer to diffusion of oxygen into the blood. Some candidates focused their answer more on the effect of salbutamol binding to the adrenaline receptors rather than on the reasons for the higher concentration of oxygen in the blood.

(ii) Explain why taking salbutamol increases the concentration of oxygen in the blood compared with not taking salbutamol.

(3)

This is because salbutamol increases the rate at which volume of air is exhaled (till 2s) This means that for the same duration, a greater volume of carbondioxide is expelled, ~~so~~ compared to without salbutamol so there is a greater pressure difference (compared to atmospheric pressure), so greater volume of ~~air~~ oxygen inhaled so the greater the concentration gradient. So oxygen diffuses into RBC at a quicker rate, increasing oxygen concentration in blood.

(Total for Question 4 = 9 marks)

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 3 marks.

The candidate clearly describes the increase in rate of air movement and links this with the concentration gradient and diffusion rate of oxygen into the blood.

(ii) Explain why taking salbutamol increases the concentration of oxygen in the blood compared with not taking salbutamol.

(3)

there is an increase in the volume of air exhaled this causes a steep concentration gradient to be formed so diffusion of oxygen into the blood increases. With less volume of air there is a greater pressure so more oxygen is forced back into the lungs - the graph is more steep compared to before taking salbutamol showing that there is an increase of oxygen

ResultsPlus
Examiner Comments

This is a very good answer that gains all 3 marks.

The candidate describes the increased volume of air, the concentration gradient and the rapid diffusion of oxygen into the blood.

(ii) Explain why taking salbutamol increases the concentration of oxygen in the blood compared with not taking salbutamol.

(3)

As salbutamol blocks adrenaline receptors, an EPSP cannot be formed on the post-synaptic membrane so muscles in the bronchi cannot contract as much. As they relax, this allows for increased surface area for gas exchange as they widen, allowing more oxygen to diffuse into the capillaries and increasing the concentration of oxygen in the blood.

ResultsPlus
Examiner Comments

This answer gained 1 mark – the idea of rapid diffusion of oxygen into the blood.

Question 5 (a)

This question was a six-mark, levels-based question requiring candidates to review data about frequency of forest fires and the effects of forest fires on ecosystems. The examiners were impressed with the high quality of many of the answers seen. Many candidates gained at least three marks with a significant number going on to gain five or six. Candidates and centres are clearly preparing well for these longer, data analysis questions and many candidates correctly considered both sets of data, used their own knowledge and synthesised both sets of data. Stronger answers also recognised that after forest fires, secondary succession clearly occurs and that would affect productivity of the ecosystems. Weaker answers tended to focus on only one set of data or did not give an explanations or comments regarding the validity of the data.

*(a) Some scientists have stated that the number of forest fires is increasing due to climate change and that measures need to be taken to stop forest fires.

Analyse the data to discuss whether measures to prevent climate change need to be taken to prevent further forest fires.

(6)

•Overall, the graph 1 shows an increase in the number of forest fires from 1980 to 2003. So more damage is being done to the environment, destroying ecosystems.
•However, the number of forest fires decreases slightly from 2001 to 2004. So it is possible that the numbers are slowing and forest fires will be less of a problem for the destruction of environments and ecosystems.
• Overall number of species decreases over 40 years, so forest fires must be causing permanent damage to ecosystems and loss of plant species.
•This decreases biodiversity as well as reducing food sources for other animals in the ecosystem, disrupting the food chain and causing loss of other animal species also.
•However there is a slight increase in the number of total species between 1 to 7 years as well as for shrubs and trees.
•So forest fires may actually cause an increase in biodiversity by changing conditions and causing secondary ecological successions which eliminate competition between plant species and allow other plant species to grow. which could then habitat new animal species increasing biodiversity further. However, overall, forest fires cause drastic loss of environment and species so prevention measures are needed

ResultsPlus
Examiner Comments

This is a very good answer that gained 5 marks.

The candidate clearly discusses the data on forest fire frequency, the data on succession and has some elements of discussion on other factors and the validity of the conclusion.

*(a) Some scientists have stated that the number of forest fires is increasing due to climate change and that measures need to be taken to stop forest fires.

Analyse the data to discuss whether measures to prevent climate change need to be taken to prevent further forest fires.

(6)

There needs to be more measures in place ~~like~~ as the number of forest fires have increased from 329,000 in 1980 to 60,000 in 2005 this shows ~~the~~ number has had a great increase and even peaks at 78,000. There is a decrease in number of plant species and this causes ~~destruction~~ to demolition for animals. The number of all species decreases as the year goes by. ~~with~~ there is a peak at 7 years. After a forest fire a peak in species could occur due to secondary ~~succ~~ succession causing a new climat but after 40 years the soil ferrits could be dropped.

There needs to be more measures like effeciency of fuels and using eco friendly to fuel. ~~Stopping~~ ~~This can~~ If there was tisher legislation this could prevent climate change

ResultsPlus
Examiner Comments

This answer gained 4 marks (Level 2) as there are comments about the forest fire frequency and succession patterns, but no real discussion is included.

*(a) Some scientists have stated that the number of forest fires is increasing due to climate change and that measures need to be taken to stop forest fires.

Analyse the data to discuss whether measures to prevent climate change need to be taken to prevent further forest fires.

(6)

5 a

Over 40 years, after forest fire the number of each species increased from 1-7 years but then decreases onwards. This is because the Bottleneck species occurred non-woody species occurred which still had habitats and niches, ~~theses~~ as and didn't burn.

ResultsPlus
Examiner Comments

This answer gained 2 marks (Level 1). Only one set of data has been considered, so the answer cannot progress beyond Level 1.

*(a) Some scientists have stated that the number of forest fires is increasing due to climate change and that measures need to be taken to stop forest fires.

Analyse the data to discuss whether measures to prevent climate change need to be taken to prevent further forest fires.

(6)

Graph 1 shows how number of forest fires peak and drop each year from 1980 - 2005 (25 yr time period). However Graph 1 shows an ~~peak~~ increase in number of forest fires - 1980 = just under 30,000 2005 = 60,000. in 25 years number of forest fires have increased

a Graph 2 shows the change in plant species for 40 years after forest fire / Hazard. This forest fires is not detailed on its impact however looking from 1 year it seems to have caused ~~speci~~ Succession to occur. Year 1 shows There was just under 40 types of species overall with Around 36 types being herbaceous. This shows that the majority of old species died by the forest fires and the herbaceous species are pioneer / intermidate stage. As years increase specie types and number of species increased until the 12 yr mark. When the numbers begin to drop. This might be due to global warming. " global warming not only leads to increased forest fires but also increased drought leading to Soil ercsion and interference with the nitrogen cycle. This causes the plant species to die as less water, carbon and nutrients for the plants. Measures are needed to be token to prevent climate change or ~~both~~ Graphs' ~~with~~ continue to increase and Graph 2 will continue to decrease. ☆ Graph 1 shows that after 2005 it most likely is to continue to increase.

ResultsPlus
Examiner Comments

This answer gained 4 marks (Level 2). There are detailed comments about both sets of data, but there is no discussion so that answer cannot be Level 3.

*(a) Some scientists have stated that the number of forest fires is increasing due to climate change and that measures need to be taken to stop forest fires.

Analyse the data to discuss whether measures to prevent climate change need to be taken to prevent further forest fires.

(6)

Graph 1 shows that since 1980, the number of forest fires has been increasing with fluctuations, peaking in 2000. The numbers have risen from as low as 22000 to 78000. This implies that it is influenced by human activity that has increased the global temperature & therefore measures must be taken place to reduce the impact.

Graph 2 shows that over time, the total number of species decreases as succession takes place, with a variety of pioneer species in the form of herbaceous annual species. These will break down the ground after a forest fire & decompose to form humus so that competitor species (shrubs) are able to grow in the newly, more habitable soil. These shrubs then decrease in number as trees are able to grow as the soil gets deeper & more nutrient rich. ~~This shows~~, forming a climax community where a few species dominate the habitat. This shows that it takes 40 years for the area to fully recover from a forest fire, lowering the levels of biodiversity that will also & reduce the food & habitats of animal species, further suggesting measures should be taken to reduce forest fires. However, the data is only for forest fires in Europe so there is a lack of global data.

ResultsPlus
Examiner Comments

This is an excellent answer that gained 6 marks.

There are detailed comments about both sets of data and extensive discussion linking both sets of data and considering validity of the conclusion.

Question 5 (b)(i)

This question required candidates to calculate the species diversity index for an area of forest. Most candidates understood how to calculate the index with many gaining all three marks. A few candidates were unclear how to calculate the sum of n(n-1) and others were unclear as to what 'N' represents.

(b) In this investigation, the scientists compared the numbers of different plant species.

The scientists also calculated a diversity index for tree species 40 years after the fire. This index gave a value of 7.33.

The table shows data for an area of forest seven years after the fire.

Tree species	Number of trees
Aleppo pine	45
Silver fir	30
Beech	14
Oak	12
Chestnut	18
Plane	11

(i) Calculate the index of biodiversity (D) for the trees shown in the table for this area of forest.

Use the formula

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Give your answer to **two decimal places.**

(3)

N = 6

$\sum n$ = 3580

Answer .....

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly calculating 3580.

(b) In this investigation, the scientists compared the numbers of different plant species.

The scientists also calculated a diversity index for tree species 40 years after the fire. This index gave a value of 7.33.

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(i) Calculate the index of biodiversity (D) for the trees shown in the table for this area of forest.

Use the formula

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Give your answer to **two decimal places**.

(3)

130(129)

1980 + 870 + 182 + 132 + 306 + 110

= 4.68

Answer 4.68

ResultsPlus
Examiner Comments

This answer gained all 3 marks.

The candidate clearly shows their working. Although the correct answer gained all 3 marks, it is good practice to show all the working.

(b) In this investigation, the scientists compared the numbers of different plant species.

The scientists also calculated a diversity index for tree species 40 years after the fire. This index gave a value of 7.33.

The table shows data for an area of forest seven years after the fire.

Tree species	Number of trees
Aleppo pine	45
Silver fir	30
Beech	14
Oak	12
Chestnut	18
Plane	11

$n = 6$

$\Sigma n = 130$

44^2 1936
29^2 841
13^2 169
11^2 121
17^2 289
10^2 100

3456

(i) Calculate the index of biodiversity (D) for the trees shown in the table for this area of forest.

Use the formula

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Give your answer to **two decimal places**.

(3)

~~130~~ 130×129

3456

$= 4.85$

Answer 4.85

ResultsPlus
Examiner Comments

This answer gained 1 mark for 130 x 129 (a correct calculation of N(N-1).

Question 5 (b)(ii)

This question assessed candidates understanding of why the index of diversity is a better measurement than simply looking at the number of different species. Strong answers correctly stated that the index takes into account the populations of species or that it can show if populations change even though the number of species remains constant.

(ii) State why using the index of diversity is a more valid way of comparing biodiversity of areas than comparing the number of species.

(1)

→ there may be lots of ~~number of~~ species present, but they may only have 1 actual animal or very few organisms within the

ResultsPlus Examiner Comments

This is a good answer that clearly shows that the candidate understands that a change in population may not result in a change in species number.

(ii) State why using the index of diversity is a more valid way of comparing biodiversity of areas than comparing the number of species.

(1)

it accounts for the number of each species

ResultsPlus Examiner Comments

This is a correct answer that gained 1 mark for correctly stating that the populations are accounted for.

(ii) State why using the index of diversity is a more valid way of comparing biodiversity of areas than comparing the number of species.

(1)

→ compair even mutchiny

• because biodiversity gives as all species combined therefore more accurt the compairy

ResultsPlus
Examiner Comments

This answer gained no marks as there is no statement regarding the population sizes.

Question 5 (b)(iii)

This question was found challenging by many candidates. The question asked candidates why a high species diversity index means that areas are more resistant to change. A few candidates correctly explained that having a high index would mean that there are many different food sources, wide range of food chains and a diversity of niches. Many candidates gained credit for stating that there would be high genetic diversity if populations are high so some species would have alleles that enabled survival. Many answers gave descriptions of what a high index of diversity would mean rather than relating this to the question.

(iii) Explain why a high species diversity means that an area is more resistant to environmental changes.

(2)

Because there is a larger gene pool, there is more likely to be organisms with favourable alleles that can survive changes

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly stating that a large population would have a high gene pool and so some may have favourable alleles.

(iii) Explain why a high species diversity means that an area is more resistant to environmental changes.

(2)

More niches are available and food sources of organisms are less limited. There is also more recycle of ~~nutrients~~ a wider range of nutrients available to organisms.

ResultsPlus
Examiner Comments

This answer gained 2 marks for the ideas that there would be more niches and more food sources.

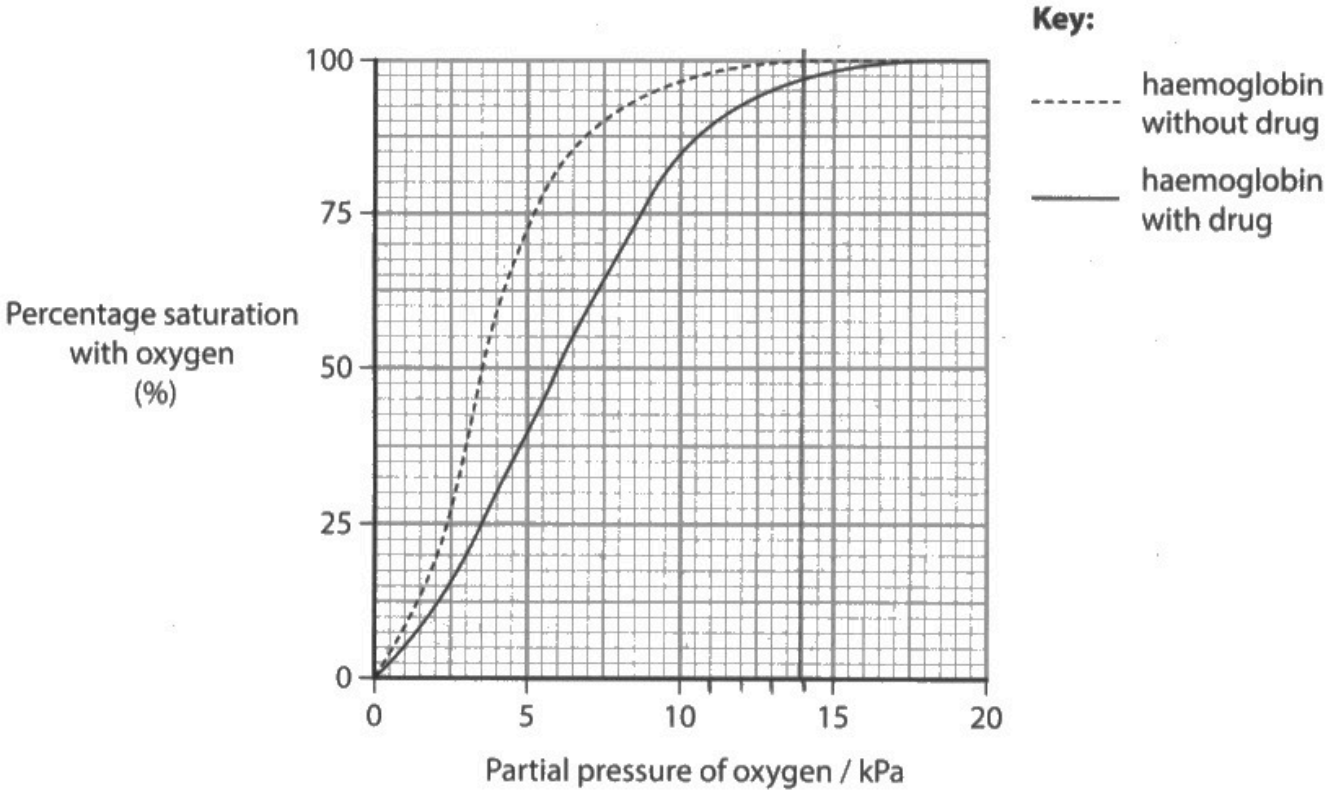
Question 6 (a)

This question assessed candidates' understanding of the shape of the oxygen dissociation curve for haemoglobin. Strong answers describe the sigmoidal shape of the curve and explained the cooperative binding by which the shape changes of subunits alters the affinity of binding. Weaker answers tended to incorrectly refer to the curve moving left and right, or gave no explanation as to why the curve is S-shaped.

6 Tissue hypoxia is a medical condition that occurs if body tissues cannot get sufficient oxygen from the blood.

Scientists have developed a drug that may help people suffering from tissue hypoxia.

The graph shows the oxygen dissociation curves for haemoglobin from a patient treated with the hypoxia drug and a patient not treated with the drug.



(a) Explain the shape of the haemoglobin dissociation curve without the drug.

(3)

It is a sigmoid curve because haemoglobin is made up of 4 subunits, 2α and 2β, and 1 O_2 molecule can bind to each. Hb exhibits co-operative binding, 1 O_2 molecule being bound increases the affinity of the other for O_2 ∴ they are more likely to bind ∴ as % sat ppO_2 increases rate of increase of % saturation increases as affinity lower at low ppO_2 and higher at high ppO_2, ∴ S shaped curve

ResultsPlus
Examiner Comments

This is a very strong answer that gained all 3 marks.

The candidate describes the sigmoid curve and then goes on to explain this in terms of cooperative binding and affinity changes.

6 Tissue hypoxia is a medical condition that occurs if body tissues cannot get sufficient oxygen from the blood.

Scientists have developed a drug that may help people suffering from tissue hypoxia.

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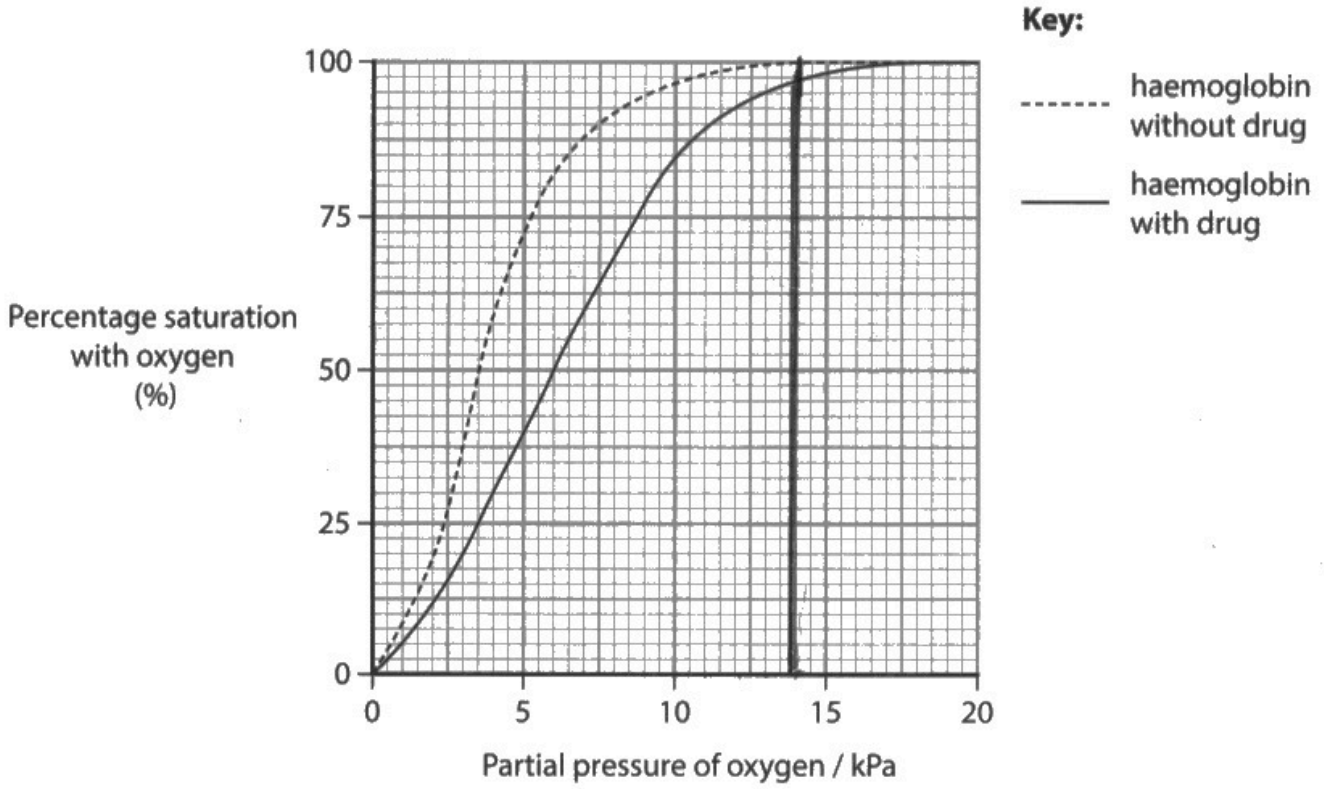

(a) Explain the shape of the haemoglobin dissociation curve without the drug.

(3)

It shows a sigmoid shape, due to affinity of O_2 changing at different partial pressures. This is because when one O_2 binds, cooperative binding occurs and the structure of haemoglobin changes to facilitate the binding of more O_2 molecules - haemoglobin becomes tense to R. This is why as O_2 partial pressure increases, affinity to O_2 increases - easy on binding of O_2 on areas like lungs and loss of O_2 at muscles where there's a low pO_2

ResultsPlus
Examiner Comments

This is another strong example that describes the sigmoidal shape and explains that this is due to cooperative binding.

6 Tissue hypoxia is a medical condition that occurs if body tissues cannot get sufficient oxygen from the blood.

Scientists have developed a drug that may help people suffering from tissue hypoxia.

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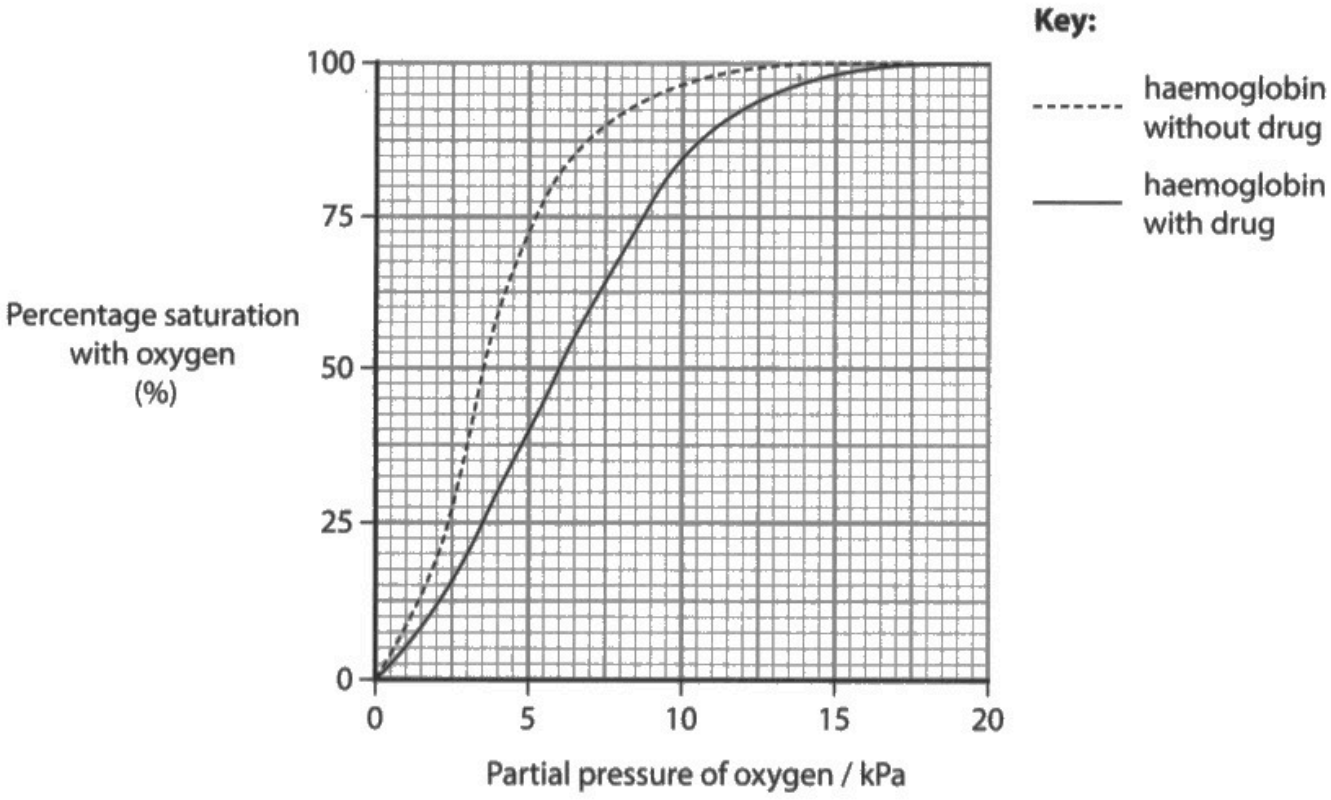


(a) Explain the shape of the haemoglobin dissociation curve without the drug.

(3)

The haemoglobin dissociation curve has an S shape. The start is is ~~less~~ slightly more diagonal. This is because haemoglobin at the beggining needs a higher ~~partial pressure for~~ a lower partial pressure of O_2 ~~for~~ for ~~of~~ less saturation of oxygen and its ~~is harder~~ affinity for O_2 is lower. It straitens as this is when its affinity for O_2 is at its best. Then ~~curves~~ slightens off because similarly it's affinity for O_2 is ~~lower~~ too high so can't release it.

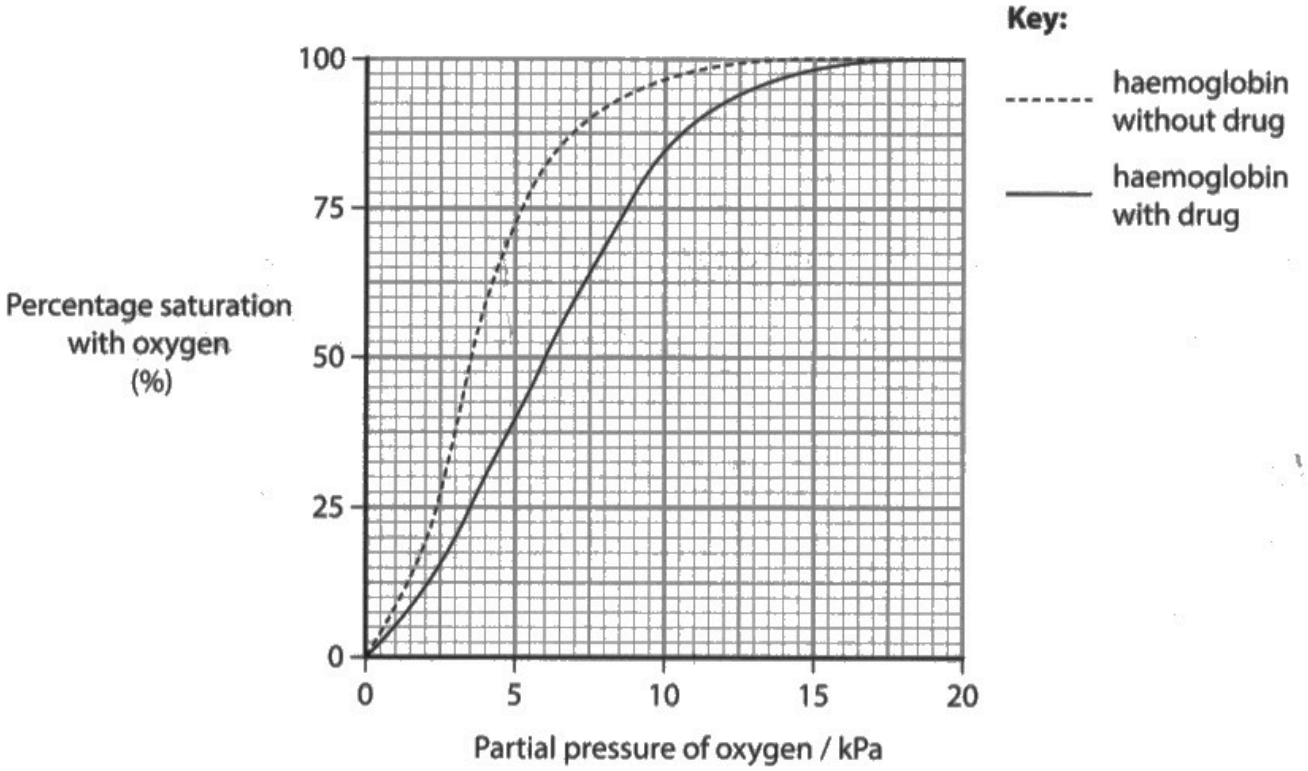
ResultsPlus
Examiner Comments

This answer gained 1 mark for the description of the curve as being S-shaped. The candidate does refer to differences in affinity, but these are not in the correct context.

6 Tissue hypoxia is a medical condition that occurs if body tissues cannot get sufficient oxygen from the blood.

Scientists have developed a drug that may help people suffering from tissue hypoxia.

The graph shows the oxygen dissociation curves for haemoglobin from a patient treated with the hypoxia drug and a patient not treated with the drug.



(a) Explain the shape of the haemoglobin dissociation curve without the drug.

(3)

Without the drug, the partial pressure of oxygen ~~that percentage~~ occurs slower and the percentage saturation with oxygen is greater as more haemoglobin is binding to ~~oxygen~~ red blood cells, yet at a slower rate, meaning that oxygen is not being transported as quickly as a ~~normal~~ standard persons. As partial pressure reaches around 10.25, the saturation of oxygen starts to be 100%. in comparison to with the drug which starts at 15.15%.

ResultsPlus
Examiner Comments

This answer gained no marks. The answer does not contain any of the mark points and the candidate incorrectly suggests that the curve shows the rate of oxygen binding.

Question 6 (b)

This question presented candidates with the oxygen dissociation curves for haemoglobin with and without a drug used to treat tissue hypoxia. The question asked candidates to use the data to explain why the drug would be more effective compared with giving more oxygen. Strong answers explained that the haemoglobin is already saturated in the lungs so adding more oxygen would make no difference and that the drug would shift the curve to the right (similar to a Bohr shift) so that affinity is lowered at lower oxygen partial pressures so that oxygen is more easily unloaded. Weaker answers often suggested that affinity would increase or focused more on the practical problems associated with delivering extra oxygen.

(b) The partial pressure of oxygen in the alveoli is approximately 14 kPa.

Explain why giving a patient the drug is a more effective method of treating tissue hypoxia than increasing the partial pressure of oxygen in the inhaled air.

(3)

Increase

drugs are easier to prescribe and are easier to be taken, changes in the environment are more suited than internal changes.

ResultsPlus
Examiner Comments

This answer gained no marks.

There is no analysis of the data and the candidate has simply focused on the practical issues of supplying more oxygen.

(b) The partial pressure of oxygen in the alveoli is approximately 14 kPa.

Explain why giving a patient the drug is a more effective method of treating tissue hypoxia than increasing the partial pressure of oxygen in the inhaled air.

(3)

- The drug moves the dissociation curve to the right, decreasing oxygen affinity
- Without the drug, increasing the partial pressure of oxygen has no effect on the percentage saturation with oxygen
- With the drug, the percentage saturation with oxygen decreases from 100% to 97.5%.
- This allows haemoglobin to unload oxygen to body tissues, which treats tissue hypoxia

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 3 marks.

The candidate clearly describes the shift of the curve and the effects of this in terms of affinity and also states that adding extra oxygen would have no effect on binding.

(b) The partial pressure of oxygen in the alveoli is approximately 14 kPa.

Explain why giving a patient the drug is a more effective method of treating tissue hypoxia than increasing the partial pressure of oxygen in the inhaled air.

(3)

~~increased~~ in partial pressure ~~at~~ around ~~15~~ 13 kpa haemoglobin is already full ~~saturated~~ so increasing partial pressure of oxygen ~~would~~ wouldn't ~~increase~~ increase the saturation of haemoglobin. The drug ~~and~~ causes oxygen to ~~dissociates from~~ dissociate from haemoglobin more readily into cells so cells get more oxygen, decreasing the effects of tissue hypoxia.

ResultsPlus
Examiner Comments

This answer gained 2 marks.

The candidate clearly explains that adding more oxygen would make no difference to the saturation and then explains that the drug would cause easier unloading of oxygen to the tissues.

Question 7 (b)(i)

This question presented candidates with graphical data showing the changes in core temperature, skin temperature and sweat production before and after exercising. Many candidates showed an understanding of thermoregulation, but often gave answers that lacked detail. Strong answers stated that the core temperature rise was lower than the skin temperature rise and went on to explain that hypothalamus detects the blood temperature. Weaker answers often mentioned a temperature rise but did not compare them and mentioned the hypothalamus but did not link it to the monitoring of blood temperature. Strong answers also explained that the skin temperature rise was due to vasodilation and that the evaporation of water from the sweat reduces the body temperature. Weaker answers often mentioned the process of vasodilation, but did not link it to the change in skin temperature. Candidates should be careful to give accurate answers – a significant number referred to vasodilation of capillaries or veins and/or the movement of blood vessels rather than the change in flow of blood. Candidates should also be clear that it is the water that evaporates rather than all of the sweat.

(i) Explain the changes in core body temperature and skin temperature during exercise, using the information in the graphs.

(4)

During ~~exer~~ exercise metabolic ~~at~~ activity is increased, due to the increased demand for energy. Consequently core body temperature ~~tt~~ is increased ~~.St~~. This increase happens slower with an increase of only around 0.5 because metabolic activity is steady. ~~t~~ Temperature on forearms increases due to heat being released from the body so it doesn't overheat. This happen far more quickly ~~as~~ because as exercise occurs temperature increases rapidly so the heat is required to be released.

ResultsPlus
Examiner Comments

This answer gained 1 mark for the idea that metabolic activity increases during exercise and then increases the temperature.

(i) Explain the changes in core body temperature and skin temperature during exercise, using the information in the graphs.

(4)

During exercise, the core body temperature increases (0.6°C) but only slightly, Whereas, the forearm skin temperature increases by 2.25°C. This is due to vasodilation where ~~more~~ blood flow increases near the surface of the skin due to vascular muscles not contracting, so that heat can be lost by a temperature gradient. This is so the core temperature ~~is regulated~~ doesn't change dramatically.

(The change is sweat production increases during exercise as sweat is produced to cool the body There's no sweat at rest due to no need for cooling)

ResultsPlus
Examiner Comments

This answer gained 2 marks.

The candidate clearly states that both temperatures rise, but the skin temperature rises more. The candidate also states that the rise in skin temperature is due to vasodilation. No marks are awarded for the references in sweat as the cooling is not linked to evaporation.

(i) Explain the changes in core body temperature and skin temperature during exercise, using the information in the graphs.

(4)

Respiration is an exothermic proces. Muscle tissue performs respiration during exercise to provide it with energy to contract.

Sweating is a way of lowering body temperature: water has a high heat capacity, so when sweat is released from the skin, it evaporates and takes a large quantity of heat with itself. Because sweat production is a response to heat release in intense exercise, it lags slightly behind (sweat production only starts to rise after the 20th minute, while exercise begins after 15 min) the exercise.

The temperature of both the skin on the forearm and the core body rise due to respiration in muscle; however, the rise in the t° of the forearm is greater because 1) the muscles of the forearm must be the ones directly involved in the exercise and 2) the arm is an extremity, more prone to changes in temperature than the core which contains vital organs.

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 4 marks.

The candidate clearly states that respiration increases the temperature, and goes on to explain how sweating lowers the temperature through evaporation. The candidate also describes the difference in temperature rises of the skin and blood.

(i) Explain the changes in core body temperature and skin temperature during exercise, using the information in the graphs.

(4)

During exercise, body temperature ~~and skin~~ increases due to an increased rate of respiration, which is an exothermic process releasing heat. much more than core body temp (+2.25°C)
Skin temperature increases as in order to maintain a (homeostasis)
constant body temperature, the hypothalamus detects a change in temperature and causes vasodilation, where arteriovenular shunts close so blood is transported to superficial capillaries and heat energy is lost through skin as radiation to environment.
This causes heat to be lost so ∝ body temperature only increases by ~0.5°C.

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 4 marks.

The candidate links respiration with the increase in temperature, describes the rises in temperatures and explains the role of vasodilation in raising the skin temperature.

Question 7 (b)(ii)

This straightforward question assessed candidates' understanding of how ectotherms attempt to regulate their body temperatures. Most candidates were able to state a correct method such as basking in the sun or finding shade. A small number of candidates confused ectotherms with endotherms and suggested sweating.

(ii) Mammals are endotherms.

Give **one** method that **ectotherms**, such as reptiles, can use to thermoregulate.

(1)

lying in the sun to absorb heat / infrared radiation

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly stating that ectotherms lie in the sun.

(ii) Mammals are endotherms.

Give **one** method that **ectotherms**, such as reptiles, can use to thermoregulate.

(1)

~~Basking in Sun~~ Sheltering in Shade

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly stating that reptiles will shelter in the shade.

Question 7 (b)(iii)

Many candidates found this question challenging. The question asked candidates to explain how positive feedback would lead to hypothermia. Strong answers explained that positive feedback occurs when a system continues to keep changing a condition further away from the norm. Some candidates correctly stated that once the body cools beyond a limit, the body will continue to cool even faster. Strong candidates explained that the cooling of the body would slow chemical reactions leading to less release of heat energy and further cooling. Many candidates confused positive feedback with negative feedback and suggested that the body would correct any changes in temperature.

(iii) Hypothermia occurs when thermoregulation does not work and the body temperature of a mammal becomes too low.

If the body is unable to thermoregulate, core temperature decreases rapidly.

Explain how **positive feedback** results in a decrease in core body temperature.

(2)

When temperatures are very low this causes rate of respiration to drop (as enzymes in respiration cannot work as efficiently) and in turn less heat is released in respiration causing body temperatures to drop further.

ResultsPlus
Examiner Comments

This is a strong answer that explains that the body continues to cool and that this slows chemical reactions releasing less heat.

(iii) Hypothermia occurs when thermoregulation does not work and the body temperature of a mammal becomes too low.

If the body is unable to thermoregulate, core temperature decreases rapidly.

Explain how **positive feedback** results in a decrease in core body temperature.

(2)

Positive feedback is a mechanism where the change in an organism keeps changing in the same direction. If the mammal is unable to thermoregulate and core temperature decreases, positive feedback will make the mammals temperature carry on decreasing as a result and could cause hypothermia.

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly explaining the nature of positive feedback.

(iii) Hypothermia occurs when thermoregulation does not work and the body temperature of a mammal becomes too low.

If the body is unable to thermoregulate, core temperature decreases rapidly.

Explain how **positive feedback** results in a decrease in core body temperature.

(2)

Decrease in temperature means metabolic reactions occur slower because the enzymes work slower due to lower temperatures. This means less heat energy can be produced by aerobic respiration, causing the body temperature to decrease further.

ResultsPlus
Examiner Comments

This is an excellent answer that explains that a lower temperature results in slower reaction rates and less heat loss through respiration.

Question 7 (c)

This question required candidates to describe how activity of the hypothalamus leads to the production of concentrated urine. Strong answers explained that when dehydrated, the blood water potential would be lower and this stimulates osmoreceptors in the hypothalamus leading to the release of ADH via the pituitary. Weaker answers referred to lower body water rather than blood water potential and sometimes suggested that there would be less ADH released. Strong answers also explained that ADH causes the collecting ducts of the kidney to become more permeable so that more water is reabsorbed into the blood. Many candidates demonstrated impressive knowledge of the action of ADH, often referring to aquaporins in the cell membranes. Weaker answers often failed to mention the collecting duct, simply referring to the absorption of water by the kidney.

(c) The hypothalamus plays a role in osmoregulation.

Describe how stimulation of the hypothalamus leads to the production of concentrated urine.

(3)

Stimulation of osmoreceptors in the hypothalamus stimulate the release of ADH ~~ADH~~ into the blood. The ADH reaches the kidneys and nephrons and makes the collecting duct more permeable. this ~~a~~ makes the collecting duct release more water into the tissues and blood. less water in the waste ~~is~~ collected means that the urine ~~secreted~~ released is more concentrated.

ResultsPlus
Examiner Comments

This answer gained 2 marks for the release of ADH causing the collecting ducts to be more permeable. Mark point one was not awarded as there is no mention of water potential or blood concentration.

(c) The hypothalamus plays a role in osmoregulation.

Describe how stimulation of the hypothalamus leads to the production of concentrated urine.

(3)

lets kinetic energy so fewer enzyme substrate complexes form.

- osmoreceptors in hypothalamus detect lower water potential (Ψ) in blood as ~~osmor~~ osmoreceptors shrivel
- so hypothalamus sends action ~~potential~~ (AP) to pituitary gland so more ADH produced so more ADH binds to receptors in collecting duct cells so more aquaporins fuse to ~~filtrate~~ ~~nephron~~ collecting duct membrane so more reabsorption of ~~of~~ water by osmosis down Ψ gradient lowering ↑ collecting ~~duct Ψ~~ duct Ψ so more ~~conc~~ concentrated urine

ResultsPlus
Examiner Comments

This excellent answer gained all 3 marks.

The candidate correctly states that low blood water potential stimulates osmoreceptors in the hypothalamus causing release of ADH which causes aquaporins to be present in the collecting duct membrane, so more water is reabsorbed.

(c) The hypothalamus plays a role in osmoregulation. WP → osmoreceptor

Describe how stimulation of the hypothalamus leads to the production of concentrated urine. shrinks → less ADH → low volume (3)

When water content and thus water potential of the blood is decreased, the osmoreceptor shrinks. As a result, less action potentials are sent to the hypothalamus which means less are sent to the gland that secretes ADH. Less ADH hormone means more water from urine is reabsorbed. This produces a lower volume of higher concentrated urine.

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly stating that the low water potential of the blood simulates osmoreceptors. The candidate incorrectly suggests that ADH release would reduce and there is no reference to blood when water reabsorption is mentioned.

Question 8 (b)(i)

This question was well answered by many candidates with many gaining both marks. Candidates had to read the value for speed of transmission of the impulse for an axon diameter of 12 µm and use this to calculate the distance travelled in 400 ms. A few candidates forgot to convert units – candidates should always be careful to make sure that units are consistent.

(i) Calculate the distance that an action potential would move in 400 milliseconds along a myelinated axon with a diameter of 12 µm.

Give your answer in metres.

(2)

Distance = 70 m × (400 milliseconds ÷ 1000)

= 70 m × 0.4

= 28 m

Answer 28 m

ResultsPlus
Examiner Comments

This correct answer gained both marks.

The candidate clearly shows their working – an example of good practice.

(i) Calculate the distance that an action potential would move in 400 milliseconds along a myelinated axon with a diameter of 12 µm.

Give your answer in metres.

(2)

68 m/s 0.4 × 68 = 27.2

68.1

Answer 27.2 m

ResultsPlus Examiner Comments

This answer also gains both marks – a range of answers between 27.2 and 28.0 was accepted.

(i) Calculate the distance that an action potential would move in 400 milliseconds along a myelinated axon with a diameter of 12 µm.

Give your answer in metres.

(2)

$\frac{400}{70}$ mps = 5.7 × 400 = 2280 m

Answer ~~2~~ 2280 m

ResultsPlus Examiner Comments

This answer gained 1 mark for correctly reading the graph to obtain the speed.

Question 8 (b)(ii)

This question was well answered by many candidates who demonstrated an excellent knowledge of saltatory conduction. Strong answers recognised that there would be fewer nodes of Ranvier and so there would be less saltatory conduction and so the impulse would have to travel along the whole membrane. Weaker answers tended to not use technical vocabulary and went no further than stating that the speed of transmission of the impulse would be slower.

(ii) Some varieties of dog can have delaminating disease when the myelin sheath of neurones is lost.

Explain why dogs with delaminating disease respond more slowly to stimuli.

(2)

- The lack of a myeline sheath means that saltatory conduction can not occur
- So impulses travelled slowly across a neurone, resulting in slower response times

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that the impulses travel slower as the transmission is not saltatory.

(ii) Some varieties of dog can have delaminating disease when the myelin sheath of neurones is lost.

Explain why dogs with delaminating disease respond more slowly to stimuli.

(2)

Saltatory conduction can no longer occur meaning an action potential can no longer move from one node of ranvier to the next. The whole axon has to be depolarised in order for an action potential to occur and this takes a lot longer than saltatory conduction meaning dogs with delaminating disease respond more slowly to stimuli.

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that there are fewer nodes of Ranvier and so saltatory conduction cannot occur.

(ii) Some varieties of dog can have delaminating disease when the myelin sheath of neurones is lost.

Explain why dogs with delaminating disease respond more slowly to stimuli.

(2)

when myelin sheath is lost the diameter of the axon is lowered as shown on the graph the lower the diameter of the axon the slower the speed of transmission. as the nerve impulse is slower, the reaction is slower ∴ respond slower to stimuli

ResultsPlus
Examiner Comments

This answer gained 1 mark for the slower impulse transmission.

No further credit was awarded as there is no explanation and the answer simply describes the graph.

Question 8 (c)(ii)

This question asked candidates to describe how an ipsp is generated in a post-synaptic neurone. Many excellent answers were seen that explained the opening of calcium channels, the entry of calcium, the movement of vesicles to the pre-synaptic membrane and the diffusion of neurotransmitter across the cleft. A few candidates confused the generation of an ipsp with an epsp and incorrectly suggested that the neurotransmitter would bind to receptors and lead to the opening of sodium channels. Strong answers explained that the neurotransmitter would cause the entry of chloride ions leading to hyperpolarisation. Some candidates wrote answers using imprecise language, for example, calcium ions are $Ca^{2+,}$ not Ca^{+}' the calcium diffuses through the pre-synaptic membrane not the post-synaptic membrane.

(ii) Describe how the arrival of an action potential at a presynaptic neurone leads to the generation of an inhibitory postsynaptic potential (ipsp) in the postsynaptic neurone.

(4)

When an action potential is reached in the presynaptic neurone, this causes voltage gated Ca^{2+} channels to open & Ca^{2+} influx occurs which causes vesicles containing acetylcholine (Ach) to move to the presynaptic membrane & the acetylcholine leaves by exocytosis to the post synaptic neurone where Ach binds to receptors. This causes the influx of Cl^- ions into the post synaptic neurone which reduces the potential difference in which reduces action potentials causing ipsp.

ResultsPlus
Examiner Comments

This excellent answer gained all 4 marks.

The candidate clearly explains the inflow of calcium ions and goes on to explain how an inhibitory neurotransmitter causes chloride ions to enter the post-synaptic neurone.

(ii) Describe how the arrival of an action potential at a presynaptic neurone leads to the generation of an inhibitory postsynaptic potential (ipsp) in the postsynaptic neurone.

(4)

Action potential reaches the presynaptic neurone. Sodium channel open. Sodium pranses. Potassium (K^+) ions move out.

ResultsPlus
Examiner Comments

This answer gained no marks – the candidate has confused the entry of calcium ions with sodium ions.

Cl^- channels'

(ii) Describe how the arrival of an action potential at a presynaptic neurone leads to the generation of an inhibitory postsynaptic potential (ipsp) in the postsynaptic neurone.

(4)

An action potential will arrive at the pre-synaptic terminal. The vesicles will move to the membrane and calcium ion channels will not open. Instead, chloride ion channels in the post synaptic neurone will open, causing an influx of chloride ions into the post synaptic neurone. This results in the potential difference of the post synaptic neurone to become more negative, so it is unable to depolarise as it becomes hyperpolarised. This means the action potential cannot continue and so an ipsp has been generated.

ResultsPlus
Examiner Comments

This answer gained 2 marks for correctly stating that chloride channels open and chloride enters, resulting in hyperpolarisation.

(ii) Describe how the arrival of an action potential at a presynaptic neurone leads to the generation of an inhibitory postsynaptic potential (ipsp) in the postsynaptic neurone.

(4)

As an action potential arrives in presynaptic neurone, presynaptic knob depolarises, causing calcium ion channels to open and Ca^+ flood in by diffusion. This triggers vesicles containing neurotransmitter to fuse with presynaptic membrane and neurotransmitter released into synaptic cleft. Neurotransmitter diffuses across synaptic cleft and binds to receptor sites on chlorine ion channels (on postsynaptic neurone membrane) so the Cl^- channels open and Cl^- diffuse into (postsynaptic neurone). This makes potential difference in cytoplasm of postsynaptic knob more negatively charged so threshold cannot be reached and no action potential can be sent.

ResultsPlus
Examiner Comments

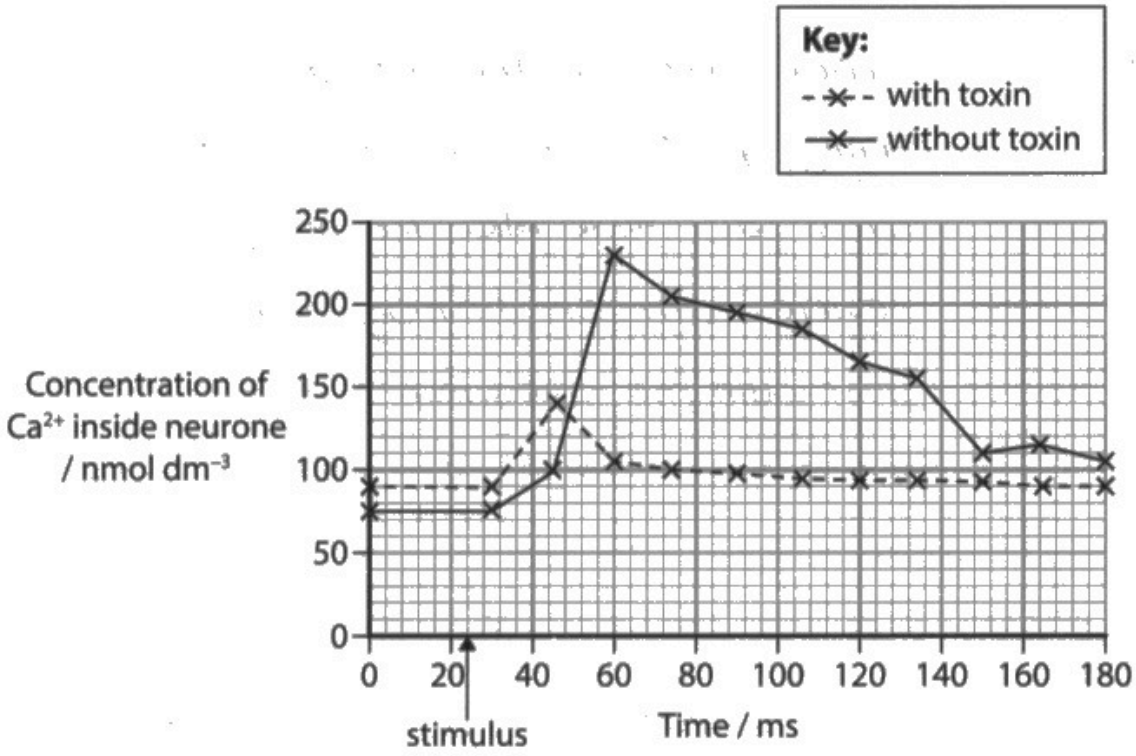
This answer gained 4 marks.

Mark point one was not awarded as the candidate has written Ca^+ rather than Ca^{2+}. Marks are awarded for the fusion of vesicles and release of neurotransmitter, the binding of neurotransmitter to receptors, the entry of chloride, and the idea that the post-synaptic membrane cannot generate an action potential.

Question 8 (c)(iii)

This question presented candidates with the effect of conotoxin on the calcium concentration of a pre-synaptic neurone. Many candidates gained at least one mark with around a quarter of these going on to gain all three. Strong answers correctly identified that less calcium entered the neurone when the toxin was present. Strong answers also explained that the toxin must bind to the calcium channels and that there would be no release of neurotransmitter so that muscles could not contract. Some candidates described the data, but did not offer any explanation as to how the toxin has its effect.

(iii) The graph shows the changes in concentration of calcium ions inside the **presynaptic terminal** of a neurone after stimulation with toxin and without toxin.



Analyse the data to explain why this toxin causes paralysis of prey animals.

(3)

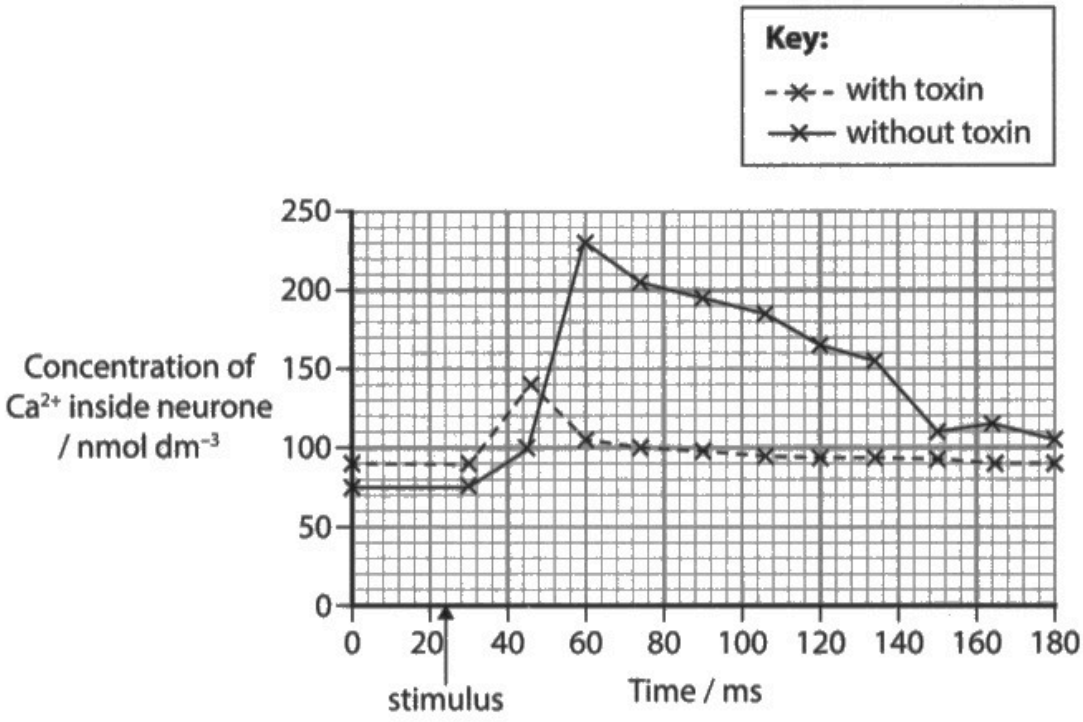
With Lower concentration of calcium ions inside the neurone with the toxin both increase upon stimulus but more is much lower with the toxin than without. Both decrease after 6 ms. ~~If there are less~~ The toxin blocks calcium channels on the presynaptic neurone therefore less calcium ions diffuse into the presynaptic neurone. Therefore less vesicles move to presynaptic membrane as less acetylcholine released to the synaptic cleft. Less sodium channels are open in the postsynaptic neuron so less sodium ions can move into the postsynaptic neuron. Therefore ~~the~~ not enough sodium ions move in to reach ~~the~~ threshold so action potential will not form. The neuron remains polarised and no nerve impulse is transmitted to muscles so muscles cannot contract.

ResultsPlus
Examiner Comments

This excellent answer gained all 3 marks.

The candidate has correctly stated that the toxin binds to calcium channels, there is less inflow of calcium and that there would be less neurotransmitter release and no muscle contraction.

(iii) The graph shows the changes in concentration of calcium ions inside the **presynaptic terminal** of a neurone after stimulation with toxin and without toxin.



Analyse the data to explain why this toxin causes paralysis of prey animals.

(3)

The toxin means that after a stimulus, the concentration of calcium doesn't increase the way it does without the toxin, therefore the neurone is not able to function effectively and deliver messages it needs to, therefore if there are no messages being delivered to and from the brain, and therefore no response to stimulus.

ResultsPlus
Examiner Comments

This answer gained 1 mark for correctly stating that there is less inflow of calcium with the toxin. No further explanation is given, so no more marks were awarded.

Question 9 (a)(i)

This question was well answered by many candidates and it was pleasing to see that many fully understood that starting a population with few lions would be a founder effect and so result in a small gene pool. Strong answers went on to explain that a small gene pool means that there is a high probability of two parents having two harmful recessive alleles. Many answers showed excellent use of terminology, such as founder effect, genetic bottlenecks, and gene pools.

9 Asiatic lions are endangered animals. Some of these lions have been kept in zoos for many years.

The photograph shows a group of Asiatic lions.

(Source: © FELIS IMAGES / NATURE PICTURE LIBRARY / SCIENCE PHOTO)

In 2017, a European zoo stated that 392 lions in captivity had died over a period of 14 years. Of these, 80% were less than one year old.

(a) (i) The population of Asiatic lions in the zoo was initially started by breeding from nine lions.

Explain why many of the next generations of lions died before they were one year old.

(2)

Nine lions is a very small population size, so inbreeding ~~has~~ has occured. ~~There~~ Theres a small gene pool and reduced genetic diversity among these 9 ~~lions~~ lions and due to inbreeding its more likely that disease causing allele / disadvantageous alleles, two copies of recessive alleles for disease are more likely to be ~~passed on~~ passed on so the next generation lions had the same genetic material as the ~~lions~~ lions that had died, so they inherited the same disease and died, population bottleneck has occured.

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that the gene pool is small and that there is a high chance that a lion would inherit two recessive alleles. References to interbreeding were ignored.

9 Asiatic lions are endangered animals. Some of these lions have been kept in zoos for many years.

The photograph shows a group of Asiatic lions.

(Source: © FELIS IMAGES / NATURE PICTURE LIBRARY / SCIENCE PHOTO)

In 2017, a European zoo stated that 392 lions in captivity had died over a period of 14 years. Of these, 80% were less than one year old.

(a) (i) The population of Asiatic lions in the zoo was initially started by breeding from nine lions.

Explain why many of the next generations of lions died before they were one year old.

(2)

A population bottleneck was formed since only 9 lions were bred in ~~captivat~~ ~~captivat~~ captivity. The gene pool was very small & hence there was a huge lack of genetic diversity. It is likely that the lions died due to disease and none were fit enough to survive due to the lack of ~~genetically diverse~~ genetic diversity.

ResultsPlus
Examiner Comments

This answer gained 2 marks for the idea of a bottleneck and small gene pool.

9 Asiatic lions are endangered animals. Some of these lions have been kept in zoos for many years.

The photograph shows a group of Asiatic lions.

(Source: © FELIS IMAGES / NATURE PICTURE LIBRARY / SCIENCE PHOTO)

In 2017, a European zoo stated that 392 lions in captivity had died over a period of 14 years. Of these, 80% were less than one year old.

(a) (i) The population of Asiatic lions in the zoo was initially started by breeding from nine lions.

Explain why many of the next generations of lions died before they were one year old.

(2)

Due to breeding from only nine lions the next generations have been a product of inbreeding which has reduced the gene pool making them more susceptible to diseases.

ResultsPlus
Examiner Comments

This answer gained 1 mark for the idea of a small gene pool – no further credit was awarded.

Question 9 (a)(ii)

This question about the Hardy-Weinberg equation required candidates to calculate the frequency of heterozygotes in the population. Most candidates were able to correctly calculate the frequency and gain two marks. A few candidates did not know how to carry out the calculation. Candidates should practise all the steps in a Hardy-Weinberg calculation: find q^2, find q, find p (from p+q=1), and then find 2pq.

(ii) Some of the young lions have a condition of the nervous system caused by a recessive allele.

In wild populations of Asiatic lions, this recessive allele has a frequency of 0.02.

In zoo populations of Asiatic lions, the recessive allele has a frequency of 0.30.

Determine the frequency of heterozygous Asiatic lions in **zoo** populations.

Use the Hardy-Weinberg equation

$$p^2 + 2pq + q^2 = 1$$

(2)

$q = 0.30$
$p = 0.70$
$\Rightarrow p + q = 1$
$2 \times 0.3 \times 0.7 = 0.42$

Answer 0.42

ResultsPlus
Examiner Comments

This correct answer gained both marks.

(ii) Some of the young lions have a condition of the nervous system caused by a recessive allele.

In wild populations of Asiatic lions, this recessive allele has a frequency of 0.02. $= q^2$

In zoo populations of Asiatic lions, the recessive allele has a frequency of 0.30. q^2

Determine the frequency of heterozygous Asiatic lions in **zoo** populations.

Use the Hardy-Weinberg equation

$$p^2 + 2pq + q^2 = 1$$

(2)

$0.30 = q^2$

$\sqrt{0.30} = 0.547 = q$

$1 - 0.54 = 0.46 = p$

$0.46^2 = p^2 = 0.2116$

$2 \times 0.46 \times 0.54$

$= 0.4968$

0.50

0.49

~~0.50~~

Answer .....

ResultsPlus
Examiner Comments

This answer gained no marks. The candidate has confused q with q^2.

(ii) Some of the young lions have a condition of the nervous system caused by a recessive allele.

In wild populations of Asiatic lions, this recessive allele has a frequency of 0.02. $q = 0.02$

In zoo populations of Asiatic lions, the recessive allele has a frequency of 0.30.

Determine the frequency of heterozygous Asiatic lions in **zoo** populations.

Use the Hardy-Weinberg equation

$$p^2 + 2pq + q^2 = 1$$

(2)

$q = 0.30$

$p + q = 1$

$p = 1 - 0.30$

$p = 0.7$

$2pq = 2 \times 0.7 \times 0.3$

$= 0.42$

Answer 0.42

ResultsPlus
Examiner Comments

This answer gained both marks – the working is also very clear.

Question 9 (a)(iii)

This question was well answered by many candidates. Most were able to give at least one condition that would enable allele frequencies to remain the same. Common correct answers included no selection, migration, and random mating. A few candidates confused the conditions with the conditions for mark-release-recapture and suggested that organisms would need to not be harmed.

(iii) State **two** conditions that must occur for allele frequencies to stay constant over several generations.

(2)

1 Migration does not occur

2 Mutations do not occur

Random Mating occurs

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that migration and no mutation would need to stay constant.

(iii) State **two** conditions that must occur for allele frequencies to stay constant over several generations.

(2)

1 Limited migration - not introducing many new individuals into the population

2 Random breeding between the population

ResultsPlus
Examiner Comments

This answer gained 2 marks for the ideas of little migration and random mating.

(iii) State **two** conditions that must occur for allele frequencies to stay constant over several generations.

(2)

1 No selection pressures

2 For gene to be advantageous

ResultsPlus
Examiner Comments

This answer gained 1 mark for the idea of no selection.

Question 9 (a)(iv)

This question assessed candidates' understanding of the role of CITES. Many excellent answers were seen that gained at least one mark. Strong answers explained that CITES requires different countries to sign the treaty and that it places restrictions on trade and tries to prevent poaching. Weaker answers tended to give vague, general descriptions of conservation but gave no specific detail.

(iv) Describe how CITES helps to maintain populations of Asiatic lions in the wild.

(2)

It involves several countries to sign and help maintain this treaty and it also prevents trading of the species so border control check for any trading, and arreses anyone who is trading preventing them from trading anymore.

ResultsPlus
Examiner Comments

This answer gained 2 marks for correctly stating that the treaties are signed by several countries and that they prevent trade.

(iv) Describe how CITES helps to maintain populations of Asiatic lions in the wild.

(2)

By ensuring inbreeding is kept to a minimum to reduce the effects of hereditary diseases becoming ~~dominant~~ dominant in a species

ResultsPlus
Examiner Comments

This answer gained no marks. There is no specific reference to the role of CITES. The candidate has given general statements about zoo conservation and the prevention of inbreeding.

(iv) Describe how CITES helps to maintain populations of Asiatic lions in the wild.

(2)

By reducing and ~~aiming~~ aiming to limit trade of Asiatic lions around the world, ~~reducing~~ reducing number of species from natural environments so they are able to breed with each-other and restore their genetic diversity.

ResultsPlus
Examiner Comments

This answer gained 1 mark for the correct statement about preventing trade.

Question 9 (b)

This final question was a six-mark, levels-based question that presented candidates with two sets of data about the number of different types of animals kept in zoos and the percentage of these species of different groups that zoos engaged with research, in-situ and ex-situ conservation. Candidates were asked to use the data and their own knowledge to discuss the effectiveness of zoos as centres of conservation. Many excellent answers were seen and candidates demonstrated excellent knowledge of both the positive and negative effects of zoos. Strong answers considered both sets of data, often stating that more mammals and birds are kept in zoos compared with amphibia and invertebrates. Strong answers also discussed the relative roles of the zoos in different types of conservation and research. Many candidates showed an understanding of inbreeding depression, the humanisation of animals and the ethical issues of zoos. It was pleasing to see that many candidates made a conclusion as to the effectiveness of the zoos based on the data and considered how the zoos were effective for some species, but not others. Weaker answers tended to simply describe the data or give their own knowledge without any evaluation or comment on the effectiveness.

Analyse the data and use your own knowledge to discuss the effectiveness of zoos as centres for the conservation of animals.

(6)

Zoos are ineffective for the conservation of already endangered animals as the levels of these stay constantly low. There is a higher number of threatened animals so zoos are more effective for conservation of these species. There are a higher percentage of each group for private conservation than existing which suggests this is more effective than existing conservation.

There is a higher percentage of mammals and birds used for research than amphibians and invertebrates suggesting research is not performed for all species.

Ex situ allows for closer control and breeding of animals to increase the population however the change in environment may lead to adverse behavioural effects in animals they could decrease their health. Additionally breeding [illegible] may not be random which could decrease the diversity [illegible]. Also ex situ involves re-release however if animals are used to captivity they may not survive in the wild. In situ conservation involves leaving animals in natural environments and protecting habitats and monitoring them. This decreases stress so animals are more likely to mate however there is less control over the environment and animals which may lead to death due to environmental conditions. Also mating will be random so increase biodiversity.

ResultsPlus
Examiner Comments

This answer gained 4 marks.

The candidate has included their own knowledge and described the graphs, but has none of the higher level discussion points, this means that the answer is Level 2.

Analyse the data and use your own knowledge to discuss the effectiveness of zoos as centres for the conservation of animals.

(6)

Graph 1 shows us that mammals and birds are the most endangered and amphibians are the least however in graph 2 the most percentage kept in zoos are amphibians. Zoos provide recreation to humans whilst also ~~~~ protecting biodiversity by carrying out conservation projects. Ex situ conservation however may be problematic as taking organisms from different climates and placing them in different zoos can cause them to die as they aren't suitable to that environment. Animals in zoos can also often become dependent and may struggle when released into the wild. By providing many conservation we can either ~~~~ ~~~~ living well within their habitat. By keeping animals in zoos we can contribute to research of their evolutionary relationships & genetic similarities and differences ~~~~ whilst also explaining why they are endangered and ~~~~ how we can combat this. There are very few (< 50) organisms per sub category that are threatened that are placed in zoos for captivity and I think we should a more move at preserving biodiversity of organisms that are ~~~~ ~~~~ threatened as well.

(Total for Question 9 = 14 marks)

ResultsPlus
Examiner Comments

This is an excellent answer that gained all 6 marks. Both graphs are discussed, the candidate uses their own knowledge to support their answer and has several discussion points.

Analyse the data and use your own knowledge to discuss the effectiveness of zoos as centres for the conservation of animals.

(6)

The ~~zoos can be effective~~ data shows that there are the most endangered and threatened species of mammals and birds kept in zoos followed by invertebrates then amphibians. The zoos may be effective centres for conservation of animals as they prevent species at the verge of extinction from going extinct by keeping them in safer environments away from predators. Additionally different zoos can exchange sperm from same species to reduce the effects of inbreeding. The second graph also shows that animals kept in situ can be used for research to study the genetics and different alleles as they could potentially be used in medicine to treat diseases. However the second graph also shows that ~~much more research~~ zoos can keep animals observed in in situ conservation which is more preferable as the other species in the environment are also conserved and food webs are maintained. Additionally ex situ conservation in zoos can be bad as it can involve humans using the animals so they behave differently which can make it very hard to re introduce them into the wild. Additionally inbreeding can occur ex situ in zoos as the gene pool is small which can cause genetic bottle neck and increase number of genetic diseases. In situ conservation is also better as it conserves biodiversity in that ecosystem. Additionally the most useful research for humans is on mammals as seen in second graph and the mammals and birds are the most endangered so protecting and conserving these species in zoos means vital research can be carried out which could not be possible in the wild or extinct. Additionally, zoos have many researchers who know the best methods to conserve animals so using zoos as centres for conservation is a good idea.

Animals also have to be transported to zoos and ex situ sites which can be expensive and distressing for animals

ResultsPlus
Examiner Comments

This excellent answer gained all 6 marks. The candidate has given descriptions of both graphs, supported their discussion with their own knowledge and included several higher level discussion points.

Analyse the data and use your own knowledge to discuss the effectiveness of zoos as centres for the conservation of animals.

(6)

Zoos can be effective as there are a large number of endangered species (e.g. particularly mammals and birds) who are being conserved thus prevented from dying in the wild. There are a higher percentage of each species kept in successful conservation - this is good as this allows animals to maintain the same behavioural patterns (does not change their behaviour when released in the wild. Zoos may not be effective in ex-situ conservation, when they are not conserved in their own habitats. Zoos may reduce the size of the gene pool/gender diversity if animals are not selectively bred making organisms more susceptible to diseases.

ResultsPlus
Examiner Comments

This answer gained 4 marks.

There are some descriptions of the graph and comments about other knowledge (4 points = 3 marks).

Analyse the data and use your own knowledge to discuss the effectiveness of zoos as centres for the conservation of animals.

(6)

The first graph shows that the zoos are very much ~~long~~ last resorts for conservation as most only have animals that are already endangered. This is good because it shows they are willing to allow animals to be free and allow natural selection until it is really critical. For example there are just under 50 mammals species that are threatened and around 300 that are endangered in zoos. The second graph shows that mammals in the zoos are most likely ~~lost~~ to therefore research which suggests it may not be the most effective attempt at conservation as research can cause distress and harm to the ~~sex~~ animals. However in invertebrates and amphibians it shows that most are rehabilitated or conserved in ~~in~~ in-situ meaning they are taken from their natural environment. The second graph also shows that ex-situ is the least popular method however it is the one proven to be effective in the rehabilitation of a species as they can then re-enter their natural habitats as they aren't reliant on humans the way they are in in-situ.

(Total for Question 9 = 14 marks)

TOTAL FOR PAPER = 90 MARKS

ResultsPlus
Examiner Comments

This answer gained 2 marks.

The answer describes both graphs, but there are no higher level discussion points or other knowledge.

Paper Summary

In future series, candidates should:

- Ensure that they understand all the command words listed in the specification.
- Use A-level standard detail in their answers.
- Set out genetic crosses clearly.
- Show all working for maths questions.
- Explore all aspects of data analysis questions and use their own knowledge to suggest explanations.

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