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Examiners' Report
Principal Examiner Feedback

November 2021

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November 2021
Publications Code 9BN0_02_2111_ER
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Introduction
In was most encouraging to note that this 9BN0/02 paper enabled candidates to demonstrate their knowledge and understanding of topics 1 to 4, and 7 and 8.

Candidates offered a range of considered responses across an array of question styles and much thanks should go to both the candidates and to their teachers.

Whilst most candidates offered clear and unambiguous answers, it should be noted that there were a number of cases where the quality of expression meant that marks could not be awarded.

Question 1

(a) This item required candidates to recall two features relating to the domains of life. Whilst an encouraging number of candidates displayed a secure knowledge of this material, many felt that bacterial DNA was single-stranded as illustrated below.

The table shows some information about the three different domains.

Feature	Archaea	Bacteria	Eukaryota
DNA is circular	Yes	Yes	No
DNA is single-stranded	No	Yes	No
Growth inhibited by the antibiotic streptomycin	No	Yes	No
Name of the link between fatty acids and glycerol in lipids	Ether	Ester	Ester
Presence of cell wall	Some	Yes	Some
Methionine required for starting protein synthesis	Yes	No	Yes
Transcription factors required for transcription	Yes	No	Yes

(a) Complete the table to show the features in Bacteria and in Eukaryota.

(2)

(b) In this question, the candidates had to use the information in the table to consider the relationships between the three domains.

A good number of candidates considered the relative number of similarities between the domains to support the question, often quoting the similarities. Few, however, then related this to the evolutionary relationships.

The response supplied describes at least two similarities between the Archaea and Eukaryota so gained the third marking point. One mark was awarded.

(b) Explain how the information in the table can be used to show that the Archaea are more closely related to the Eukaryota than to the Bacteria.

(3)

Archaea are more closely related to Eukaryota than Bacteria as both Archaea and Eukaryota ~~do not require~~ are not affected by streptomycin in regards to growth inhibition whereas bacteria is. Both Eukaryota and Archae required ~~for~~ formyl Methionine for starting protein synthesis and they both need transcription factors required for transcription when bacteria does not. This suggests that the structure of DNA ~~&~~ of Eukaryota and Archaea are similar thus suggesting they are more closely related than archae is to bacteria.

(Total for Question 1 = 5 marks)

Question 2

(a) Candidates were asked to describe how genetic variation occurs during meiosis. Many recognised that this included independent assortment but sometimes candidate understanding of crossing over seemed less secure.

Whilst a pleasing number appreciated that the question focus was during the formation of gametes, it was not uncommon to read answers relating to fertilisation such as this response which was awarded 0.

(a) Describe how meiosis leads to genetic variation in the gametes produced.

(2)

Meiosis leads to genetic variation as it involves 2 gametes joining together and 23 ~~pairs of~~ chromosomes from each gamete. ~~to~~ the chromosomes within each gamete will be different thus creating genetic variation.

This second response gives a clear answer relating to both independent assortment and crossing over so was awarded both marks.

(a) Describe how meiosis leads to genetic variation in the gametes produced.

(2)

One way is through independent assortment, this is when chromosomes from both parents get randomly arranged during meiosis. Another way is through crossing over, this is when the ends of ~~chromatids~~ twist and break off from the original and reattaches to the other one.

(b) This item required candidates to explain the role of the cortical granules in preventing polyspermia.

There were many splendid answers but also a number of candidates who seemed unsure of the contents of the cortical granules.

This candidate response gains the second marking point towards the end of their answer.

(b) During random fertilisation, only one sperm cell fuses with the cell surface membrane of an egg cell. Vesicles play an important role in this process.

Explain how vesicles are involved in the successful fertilisation of an egg cell by only one sperm.

(2)

• vesicles contain the chemicals within the zona pellucida. The egg cell releases chemicals from Th vesicles to attract sperm towards itself. Once a sperm digests through zona pellucida the vesicles are able to detect the fusion and in turn, release chemicals to harden the outer layer of zona pellucida preventing entry of any other sperm.

(c) This part of question 2 required candidates to explain why some genes were linked and some sex-linked. It was rare to see answers that considered why multiple genes need to be on the same chromosome, but most wrote about both linkage and sex-linkage. For many candidates, their knowledge of sex-linkage tended to be more thorough than that of linkage.

This response initially gives a description of linkage which is credit worthy. It then correctly refers to sex-linkage, so two marks were gained.

(c) Variation between children and their parents is affected by linkage of genes.

Explain why some genes show linkage and others show sex-linkage.

(3)

Some genes will be linked due to how close they are on a chromosome, if they are close together they are more likley to be inherited together and are therefore linked. Sex linked genes will only be present on the chromosome responsible for biological sex on either the X or Y chromosome.

Question 3

(a) In this question item, candidates had to describe the structure of an unbranched polysaccharide. Many were able to deliver clear and thorough answers as illustrated in the response below, which gained both marks.

(a) Mucopolysaccharides are large molecules containing unbranched polysaccharides.

Describe the structure of an unbranched polysaccharide.

(2)

An unbranched polysaccharide is made up of many glucose monomers and joined together by 1,4 glycosidic bonds formed by condensation reactions. For example, & amylose in starch is a coiled structure and has 1,4 glycosidic bonds.

(b) Here candidates had to consider how an enzyme could breakdown the polysaccharide component of mucopolyaccharides.

Whilst there were a good number of detailed answers, a significant minority of candidates offered rather general comments about enzyme activity without linking it to the context of the question.

The first response gains no marks, but the second one can be awarded the first marking point.

(b) Mucopolysaccharides can be broken down by enzymes.

Describe how an enzyme could break down the polysaccharide component of mucopolysaccharides.

(2)

An enzyme can break down the polysaccharide by affecting only the polysaccharide section of ~~sa~~ Mucopolysaccharides, the other component is not affected by the enzyme.

(b) Mucopolysaccharides can be broken down by enzymes.

Describe how an enzyme could break down the polysaccharide component of mucopolysaccharides.

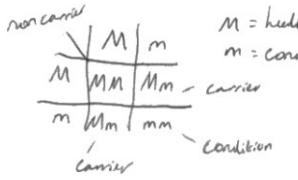
(2)

An enzyme is a globular protein that has a specific active site. when fitted with it's substrate it can catalyse a reaction. in this instance it will hydrolyse the mucopolysaccharide and break it down.

(c) In this item, candidates were asked to determine the probability that person 2 had both the same phenotype as person 1 and the same sex.

Whilst some candidates delivered targeted and detailed answers, it was not uncommon to see responses that considered genotype rather than phenotype. This is shown in the response below. In this case, the candidate could be awarded the first two marking points only.

(4)



1/4 or 25%.

50% chance of being a carrier

50% chance of male or female

Neither parent shows the condition but their child has it, the ~~disease~~ condition is recessive so both parents are carriers / heterozygous.

50% chance of being a heterozygous carrier

50% chance of either gender

Overall a 25% chance of having the same sex and phenotype as person 1.

25% 1/4

Question 4

(a) Candidates were presented with two shapes that represented two animals. They had to determine which required a circulation and which did not.

Most candidates made good use of the figures assigned to the two diagrams and were able to calculate the surface area and volume of each. Some then processed this data to make comparable surface area to volume ratios to help justify their choice of animal that did not require a circulatory system.

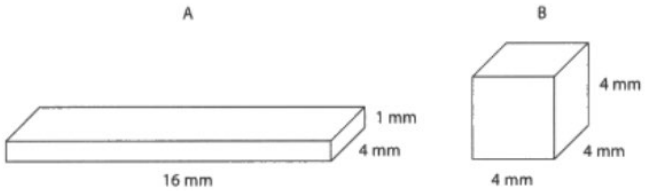
Those that did not score the higher marks either tended not to use the figures correctly or did not then consider the significance of the data in relation to diffusion being sufficient for the animal or not.

In this response, the first two marking points can be given from the calculations below animal A. The first line of the written text then uses the calculated data to deliver the third marking point. The second sentence then gained the fourth marking point, so all four marks can be awarded here.

(a) The shapes in the diagram represent two different animals that live in water.
The figures represent the height, width and breadth of the animals.

Determine why animal A does not need a circulation system but animal B does.

(4)



Animal A
SA 168 cm^2
V 64 cm^3
~~SA:V ratio~~

Animal B
SA 96 cm^2
V 64 cm^3
~~SA:V ratio~~

Animal A has a much higher surface area to volume ratio than animal B both have the same volume of 64 cm^3 but animal A's surface area is 168 compared to Animal B's 96 cm^2. The much higher surface area to volume ratio allows animal A to have a ~~much~~ much higher rate of diffusion so high that the diffusion ~~area~~ is as the organism needs animal B needs a circulatory system to maintain concentration gradient and speed up diffusion

(b) Candidates were given some symptoms and then asked to explain how a mammal with a hole in their septum could lead to those symptoms. Almost all candidates appreciated that the oxygenated and deoxygenated blood would mix.

This response not only referred to the mixing but also that there would be less aerobic respiration at respiring tissues due to reduced oxygen levels. Two marks were given for this answer.

(b) During the development of the mammalian heart, there is a hole between the left ventricle and the right ventricle.

This hole usually becomes sealed before the mammal is born. If it is not sealed, the mammal will become easily tired due to a lack of energy.

Explain why a mammal born with a hole between the two ventricles will have these symptoms.

(3)

The oxygenated and deoxygenated blood is getting mixed up between the ventricles therefore the body isn't recieving enough oxygenated blood from the aorta. There's a lack of aerobic respiration with oxygen so there's lack of energy as not enough ATP is being produced.

Question 5

(b)(i) Data was supplied for candidates to calculate a percentage increase in systolic blood pressure after drinking some coffee. It was most gratifying to note that the majority of candidates processed the data appropriately, as per the response below.

(b) Caffeine is a stimulant found in coffee.

The effect of different types of coffee on blood pressure was investigated. Decaffeinated coffee has most of the caffeine removed.

Four groups of volunteers had their blood pressure measured before having a drink and again 30 minutes later.

The results of this investigation are shown in the table.

Drink provided to volunteers	Mean systolic blood pressure / mm Hg	
	Before the drink	30 minutes later
Water	115	119
Decaffeinated coffee	120	118
Regular coffee	106	118

(i) Calculate the percentage increase in the mean systolic blood pressure after drinking regular coffee.

(1)

~~In water it increase bp increase =~~

In decaffeinated coffee decrease in bp = 2 mm Hg

Regular coffee increase = 12 mm Hg

$\frac{118-106}{106} \times 100 = 11.32$

11.32 %

(b)(ii) In this item, candidates had to use their knowledge of a core practical (*Daphnia* heart rate) to compare decaffeinated and regular coffee.

Most candidates appeared to have a good knowledge of this practical and gave appropriate procedural details and control of variables. However, few considered the need for recording the heart rate prior to coffee intake or the need for a statistical test.

In this response, the candidate gains the third and fourth marking points in the first sentence. They then refer to allowing the *Daphnia* to acclimatise, which is a suitable procedure detail for the first marking point. No further marks were seen, so three marks were awarded.

(ii) *Daphnia* can be used to investigate the effects of caffeine on heart rate.

Devise a procedure to compare the effects of decaffeinated coffee and regular coffee on the heart rate of *Daphnia*.

(4)

Firstly, produce two coffee solutions of equal concentrations (0.5 M) and same temperature (room temperature at 25°C). Using a pipette, pipette out a daphnia (and some pond water) from the beaker containing pond water onto a cavity slide. Using a tissue, dab around the daphnia to get rid of any pond water as this will dilute the coffe solutions. Add the same volume of coffe solution (2 cm^3) to the cavity slide and start timer for 1 min to let the daphnia climatise to the coffee solution. (Put the cavity slide under a microscope) After 1 min, use a ticker and press it everytime you see a heart beat in the daphnia for 30 seconds. Multiply your results by 2 to get heart beats per minute. Repeat the experiment for the coffee solution and once more for both solution to get a mean heart rate. The daphnia should be released back into the pond to minimise their suffering.

(c) This item required candidates to explain how high blood pressure increased CVD risk. Many candidates handled this question with confidence and gained good marks.

This response was typical of many, and gained the first and third marking points.

(c) Explain why high blood pressure can increase the risk of developing cardiovascular disease (CVD).

(3)

High blood pressure can cause endothelium damage. ~~This caused inflammation~~ in the arteries. This can cause atherosclerosis because white blood cells and chemical cells accumulate forming a plaque. This narrows the lumen of the arteries meaning less oxygenated blood can reach the coronary artery and thus the cardiac muscle increasing risk of a heart attack. This increases the risk of developing CVD.

Question 6

(a)(i) Candidates had to explain how an enzyme was involved in joining a spider silk gene to an antibiotic resistance marker gene. Whilst some had a thorough understanding of this as shown in the first response, it was not uncommon to read answers relating to general enzyme function or responses with a focus on a non-ligase enzyme, as illustrated in the second response. The former gained both marks and the latter, zero.

(i) Explain how an enzyme is involved in joining the two different genes together in stage 1.

(3)

enzyme catalyses condensation reaction of genes, connecting the phosphate and sugar groups of nucleotides of genes together so genes are adjacent to each other

(i) Explain how an enzyme is involved in joining the two different genes together in stage 1.

(3)

DNA polymerase forms hydrogen bonds between the gene for spider silk and antibiotic resistance marker gene. The complementary bases pair together. DNA polymerase start at the start codon and travels ~~down~~ down the gene to the stop codon joining the nucleotides bases together.

(a)(iii) This question asked candidates to explain why the GM bacteria were exposed to an antibiotic.

Most candidates appreciated that this would remove those bacteria without the marker gene, few then considered that this would also mean that the surviving bacteria also had the spider silk gene present.

This response, which gained the first marking point only, was typical.

(iii) Explain why antibiotic A is used in stage 3.

(2)

- The antibiotic will eliminate all of the non-resistant bacterium.
- Only resistant bacterium remain
- Resistant bacterium will ~~mitosis~~ reproduce via mitosis increasing the population.
- Entire population of bacterium is now resistant to the antibiotic.

(a)(iv) Candidates had to consider the role of IAA in the agar used for the GM alfalfa plants. Many candidates appeared to appreciate that IAA enabled plants to grow but did not expand on this in their answers.

This response, however, referred to root growth in the first line (third marking point) and then the mechanism on the third line (first marking point one), so both marks were achieved.

(iv) Give reasons why the infected alfalfa plant cells are grown on agar containing IAA in stage 5.

(2)

- IAA will promote the alfaalfa plants roots and stems to grow in the right directions via cell elongation.
- Roots will grow downwards
- Shoots will grow upwards by elongating one side of the tip so it bends upwards.

(a)(v) Candidates were presented with some data relating to spider silk yield and were asked to calculate the percentage increase in production by the GM plants compared to GM goats.

Most candidates tackled this item in a clear and correct manner, as illustrated by this response which gained all three marks.

(v) The table shows the mass of spider silk produced from the genetically modified alfalfa in stage 6. It also shows the mass of spider silk produced from the genetically modified goats.

Organism	Mass of spider silk produced per year
Alfalfa	218 kg per acre
Goat	10 kg per goat

A typical number of goats that can be kept on one acre of land is 12.

Calculate the percentage increase in spider silk produced by the alfalfa plants compared with the goats.

(3)

10 x 12 = 120 kg per acre from goats

$\frac{218 - 120}{120} \times 100 = 81.7\%$

81.7 %

(b) In this question, candidates had to give reasons why some people are concerned about the use of GM plants as a source of spider silk. There were a number of clear answers but also a number of general ones.

This response is rather general and was not awarded any marks.

(b) Give two reasons why some people may be concerned about the use of genetically modified alfalfa as a source of spider silk.

(2)

Cross pollination could result in non intended plants producing spider silk meaning a species has been modified by accident.

People may think that the genetic modification of organism is unnatural and may lead to ethical concerns in the future such as designer babies

Question 7

(a) In this item, candidates were expected to describe two structural differences between fast and slow twitch muscle fibres.

Whilst there were an encouraging number of excellent responses, some candidates did not focus on the requirement for the differences to be structural as illustrated in the answer below.

This response correctly identifies one structural difference in the first sentence. However, no mark can be given for the second sentence.

(a) Muscles can contain fast twitch and slow twitch muscle fibres.

(i) Describe two structural differences between fast twitch muscle fibres and slow twitch muscle fibres.

(2)

Fast twitch muscle fibres contain less mitochondria than slow-twitch muscle fibres

Slow twitch muscle fibres have more myoglobin making them red ish in colour whereas slow-twitch are whitish in colour

(b)(iii) This was the first of the two levels-based questions in this paper. Candidates were presented with various data relating to the modern triathlon and were asked to evaluate a conclusion.

It was most gratifying to read a host of responses that not only considered the mean data for both heart rate and lactate levels, but also the spread of the data in the latter. Likewise, a number of candidates, considered the methodology of the investigation that produced the data.

This response considered various aspects of the investigation process, providing evidence for level one. The candidate has also made reference to some of the lactate data overlapping, hence level 2. This answer was awarded three marks.

It was concluded that cycling was the most demanding of the three triathlon sports. This was followed by swimming and then running.

Evaluate the validity of this conclusion.

(6)

The conclusion isn't very valid due to errors in the methodology. Readings were only taken after completing each sport not during the sport meaning readings may have been taken when the athlete was tired and had stood. Furthermore there were no rest periods between events meaning the athletes were tired for the last event - running so a lower heartrate would be expected and running does have the least heartrate. Furthermore the level of intensity was being tested however only male athletes were used and the standard deviations on the graph for swimming and cycling overlap by 0.9 $nmol/dm^{-3}$ meaning lactate concentration may be insignificant. To increase validity there should be rests between the sports as well as measuring of lactate concentration and heartrate whilst the sport occurs. Furthermore the order of the sports should be changed everytime to determine if it's the sport of causing greater physical exertion or just the exercise before influencing the level of intensity.

Question 8

(b)(ii) Candidates had to offer an explanation for the importance that the outer mitochondrial membrane is impermeable to hydrogen ions.

A number of candidates appreciated that this would stop the leakage of H^+ from the mitochondrion and therefore its role in ATP synthesis. However, others offered a general description of aerobic respiration that did not focus on the thrust of the question.

In this response, there is no credit worthy comment in the first sentence. However, the second and third sentences, using the converse explanation, gained the first and last marking points, for two marks.

(ii) The outer mitochondrial membrane is not permeable to hydrogen ions (H^+).

Explain the importance of this feature of the membrane.

(4)

So In oxidative phosphorylation, H^+ ions ~~are~~ use energy to move into the intermembrane space so that they can diffuse back into the mitochondrial matrix. If the outer mitochondrial membrane was permeable to H^+ ions, then the H^+ ions may diffuse out of it and out of the mitochondria. So ATP and water would not be produced in respiration leading to cell, tissue and muscle death in the body.

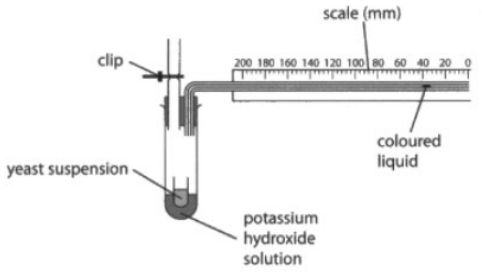
(c) In this item, candidates were required to apply their knowledge of the respirometer core practical, to devise an investigation to study Q_{10}.

Whilst there were a number of excellent responses, some others lacked the necessary precision in their answers to elicit the higher marks.

In this answer, the candidate, has not offered the detail required, hence no marks can be awarded.

(c) It has been stated that if the temperature of yeast is raised by 10 °C, the rate of respiration will double.

The diagram shows some apparatus that can be used to measure the rate of respiration in yeast.



Devise an investigation using this apparatus to determine whether an increase of 10 °C doubles the rate of respiration in yeast.

(4)

Increase the temperature of the yeast by heating it up in a water bath, by 10°C. Then monitor the coloured liquid and see if after 10°C increase the rate of respiration has increased in the scale.

Question 9

(b) In this item, students had to interpret a statistical test statement in the context of protein breakdown.

A number of candidates displayed a good understanding of the meaning of no significant difference at p=0.05, but it was not uncommon for others to interpret this as a 95% certainty that there was a significant difference.

The response below correctly refers to the meaning of the statement in terms of protein breakdown for one mark, but does not explain the importance of the p=0.05 reference.

(b) The scientists proposed a null hypothesis for the rate of breakdown of protein in the muscle cells of the two groups.

The data from this investigation showed that there was no significant difference at the 0.05 probability level.

(i) Explain what is meant by no significant difference at the 0.05 probability level for the rate of breakdown of protein.

(2)

no difference evidence from experiment shows there's ~~an~~ insignificant insufficient evidence to show there's a difference in the protein breakdown between cells on each end in space

(b)(ii) This question required the candidates to describe tertiary protein structure in relation to function for myosin.

Many candidates demonstrated a super grasp of both protein structure and function in the context of myosin. However, a minority delivered answers that failed to relate protein structure to myosin.

In this answer, the candidate has confused tertiary and quaternary as well as discussing primary structure which was beyond the scope of the question. There is no consideration of the functions specific to myosin, so no marks were given.

(ii) Some of the myosin in the muscle cells was broken down.

Describe how the tertiary structure of myosin is related to its function.

(3)

Myosin is thick and is used for muscle contraction. As it is a tertiary structure it is made by different polypeptide bonded together. These polypeptides are made of amino acids that were coded by ~~specific~~ specific genes that differentiated myosin to its function.

This response initially discusses tertiary structure without focusing on myosin (first sentence). However, they then refer to the globular head of myosin for the first marking point (second sentence) and then the function of this head (fourth sentence). In consequence, this answer gained 2 marks.

(ii) Some of the myosin in the muscle cells was broken down.

Describe how the tertiary structure of myosin is related to its function.

(3)

Tertiary Structure is the 3D structure of a protein, it contains hydrogen, ionic, disulfide bridges and hydrophobic and hydrophillic interactions between amino acids the R groups. Myosins tertiary structure is that it's a thicle protein filament and has a globular head. which means hydrophillic groups face outward and it's 3D structure is an alpha helix. This allows it to bind to the binding site on the actin filament and form a cross bridge during muscle contraction. The globular myosin head then pulls the actin filament along when stimulated.

(c) This item was the second of the levels-based questions in this paper. Candidates had to extract relevant information to discuss muscle behaviour in a novel context.

It was most pleasing to note that many candidates were able to use the information provided and relate it to astronaut muscle levels in different situations. It was less common for candidates to consider the quality of the study.

This response uses the information provided to consider the change in muscle levels in space as the astronauts travel to Mars and then once they have reached Mars. As a consequence, this answer is a level 2 response and is worth 4 marks.

*(c) Data for the rate of protein synthesis were collected for the groups of muscle cells as shown in the table.

Group of muscle cells	Mean rate of protein synthesis / arbitrary units
Group 1 cells during the 10-day space mission	40
Group 1 cells after the 10-day space mission returned to Earth	380
Group 2 cells	190

It has been estimated that astronauts will travel to Mars by 2030.
It will take about nine months to travel from Earth to Mars.

The force of gravity is less on Mars than it is on Earth, but greater than it is in space.

Discuss the potential effects of gravity on the muscles of astronauts when travelling to Mars and then living on Mars.

(6)

The mean rate of protein synthesis decreases by 150 arbitrary units during a 10 day space mission, so a million to ~~me~~ Mars over about 9 months will cause an even longer decrease in protein synthesis rates. This will lead to a high amount of muscle loss as the proteins required by the muscles (e.g actin and myosin) are being produced at far lower levels. However, once the astronauts reach on Mars the ~~longer~~ increase in gravity is likely to increase the mean rate of protein synthesis closer to normal levels, as seen with how the mean rate of protein synthesis increased by 340 units after returning to Earth (place of increased gravity). This will cause astronauts to regain muscle mass that was lost during the space flight.

This answer tends to focus on one aspect of the interaction between protein synthesis and gravity so sits in the level 1 band. There is little use of information to support their view so 1 mark was given.

*(c) Data for the rate of protein synthesis were collected for the groups of muscle cells as shown in the table.

Group of muscle cells	Mean rate of protein synthesis / arbitrary units
Group 1 cells during the 10-day space mission	40
Group 1 cells after the 10-day space mission returned to Earth	380
Group 2 cells	190

It has been estimated that astronauts will travel to Mars by 2030.
It will take about nine months to travel from Earth to Mars.

The force of gravity is less on Mars than it is on Earth, but greater than it is in space.

Discuss the potential effects of gravity on the muscles of astronauts when travelling to Mars and then living on Mars.

(6)

The rate of protein synthesis will be higher when living on Mars because it's gravity is stronger than in space ~~or on earth~~. So the muscles will grow larger than when they are travelling to Mars. because of the greater rate of protein synthesis. This may make the astronauts a lot taller and longer when the longer they stay on Mars ~~but the rate of protein synthesis will be highest when~~ compared to in space.

Question 10

(a) Candidates were presented with a graph showing the relationship between light intensity and current produced by a rod cell. Candidates had to explain this relationship.

This response only gains the second marking point which is covered in the first sentence. One mark given.

Explain the effect of increasing light intensity on the current produced by a rod cell.

(5)

- Increasing light intensity increases bleaching of Rodopsin into retinal and opsin.
- Opsin hydrolyses nonspecific cation channels reducing the electrochemical gradient
- Na+ ions continued to be actively transported out of inner segment
- So Rod cell hyperpolarises
- hyperpolarising of rod cell means no action potential is released
- So no inhibitory release of glutimate
- So bipolar neuron depolarises
- So electrochemical gradient decreases depolarises.
- and no impulses sent by rod cell so current falls in the rod cell.
- depolarisation
- repolarisation

(b)(i) This question item required candidates to describe the role of ions and neurotransmitter substance at the synapse between a neurone in the optic nerve and a brain cell.

There were a number of complete and detailed answers offered by candidates. However, some did not appear to appreciate that the focus of the question related to the synapse so wrote about depolarisation an repolarisation in the axon.

In this response, the candidate seems to have merged the role of ions across an axon membrane and at the synapse. No marks were achieved.

(b) (i) The transmission of an impulse between a neurone in the optic nerve and a cell in the brain involves ions and neurotransmitter molecules.

Describe how these ions and neurotransmitter molecules are involved in the transmission of an impulse.

(4)

Sodium channels open in the pre synaptic membrane at the neuromuscular junction which ~~neuro~~ sodium ion move across the cell surface membrane. The neurotransmitter is released which causes / triggers an action potential at the neuromuscular junction. Eventually, sodium ion wave and impulse travels down to the post synaptic membrane and potassium channels open to allow for the movement of potassium ion.

(c) Candidates had to describe the effect, on the visual region, of keeping a kitten's right eye closed during its critical period in this question item.

Many candidates appreciated that there were would be less synapses in the right ocular dominance columns or/and that these columns would be reduced in size.

This response focuses on the size of the ocular dominance columns and gains the third marking point. One mark awarded.

(c) In one experiment, Hubel and Wiesel kept the right eye of a kitten closed during the critical period.

They then studied the effect of this on the visual region of the brain of this kitten.

Describe the differences in the visual region of this kitten compared with the visual region of a kitten that had both eyes open during the critical period.

(2)

In the kitten with both eyes open during the critical period, both right and left occular dominance columns are the same size. In the kitten with the right eye stitched shut during the critical period, the left occular dominance columns will be much larger than the right occular dominance columns, and ~~also~~ larger than the left occular dominance columns in the kitten with both eyes open.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- always look to offer your response in the context of the question;
- consider carefully any data that is supplied in a question;
- take note of the mark allocation as this is an indicator of the level of content required;
- make sure you are fully conversant with the various command words;
- time permitting, read through your answers to make sure they are clear;
- make sure your writing is legible at all times.

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