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Examiners' report

BIOLOGY B (ADVANCING BIOLOGY)

H422
For first teaching in 2015

H422/02 Summer 2018 series
Version 1

www.ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper H422/02 series overview

H422/02 is one of the three examination components for the A Level linear examination for GCE Biology B. This Scientific Literacy in Biology component has 20 marks dedicated to the pre-release material. The remaining marks can be credited for short answer questions, extended writing and analytical skills including drawing graphs and interpreting varied data sets.

Compared to H422/01 (Fundamentals of Biology) there are fewer marks available on this paper for knowledge but more marks for the higher-order skills of application and analysis. A feature of the 2018 paper was a large allocation of marks for problem-solving using mathematical skills. To do well on this paper, candidates need to practise interpreting and evaluating new information and data in the light of their theoretical knowledge.

Questions candidates found easiest	Questions candidates found most challenging
1(a)(iii) knowledge of the role of myelin. 2(a) calculating the missing percentages. 2(b)(i) variables to control when measuring transpiration rate. 3(b)(i) the genetic material of HIV. 4(a)(i) definition of infertility & erectile dysfunction. 5(b)(ii) interpretation of data related to death rates in Africa. 6(c)(i) connecting the role of EPO with treating anaemia.	2(b)(ii) interpretation of data to support two conclusions. 2(c)(ii) calculating a gradient from a graph to proceed correctly with calculating the rate of transpiration, including displaying answers in standard form. 3(b)(ii) identification of structures from a diagram. 3(c)(i) explaining why there is a long delay between HIV infection and symptoms appearing. 6(b)(ii) suggest why rhEPO has been difficult to identify in the past.

There were very few if any question parts that were not attempted by the majority of candidates.

Comparing the questions candidates found easiest with those that candidates found the most challenging, it is apparent that candidates were usually well-prepared in terms of subject knowledge. The extended writing and interpretation of data displayed as bar charts or simple linear graphs were well answered. However, questions with multiple information e.g. transpiration rates in potometers and pots or birth and death rates over time in different countries, proved too challenging for the majority of candidates. This report will help remove certain misconceptions as well as suggestions for interpreting complex data

Question 1 (a) (i)

1   This question is based on the Advance Notice article **SPINAL CORD INJURIES: HOW COULD STEM CELLS HELP?**, which is an insert.

  (a)   The spinal cord contains both motor and sensory neurones.

     (i)   State one similarity and one difference between the structure of motor and sensory neurones.

        similarity ....

        ....

        difference ....

        ....

        [2]

> Similarities were well answered with a good spread of answers. Candidates who did not gain the difference mark had difficulty explaining the position of the cell body. Many candidates described the direction of the impulse and so did not appreciate the key word 'structure' in the question.
>
> ◎ Few candidates attempted diagrams to answer this but appropriately labelled diagrams would be an excellent way of illustrating both differences and similarities and avoid the difficulties some candidates encountered when trying to describe the position of the cell body for the two types of neurones. Candidates should not be restricted to text just because lines are provided.

Key
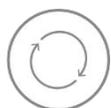
◎   **AfL**

Question 1 (a) (ii)

     (ii)   Explain why a spinal cord injury (SCI) causes both paralysis **and** loss of feeling below the site of the injury.

        ....

        ....

        ....

        .... **[2]**

> This was well answered with many candidates appreciating the relevance of the two consequences of damage to the two types of neurone. More candidates recognised the significance of the (damaged) motor neurone to paralysis than the (damaged) sensory neurone to loss of feeling.

Question 1 (a) (iii)

(iii) Describe the role of the myelin sheath in the propagation of nerve impulses.

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.... [2]

Most candidates recognised myelin as an insulator and could either state saltatory conduction or describe it.

(?) Myelin was often referred to as protecting the axon which suggests an analogy with adipose tissue in various parts of the body. This is not correct and myelin should be described purely in terms of its role in increasing the axon's membrane resistance and decreasing the membrane capacitance. Relating the role of myelin to symptoms of multiple sclerosis often helps to emphasise the importance of its function in a contextual sense. Succinct descriptions can be found at:

https://www.sciencedirect.com/topics/neuroscience/myelin

(1aii & 1aiii)

(◯) Too many candidates use terms like signals, messages and information to describe an action potential. When describing the propagation of an action potential, avoid using signalling or messaging as transitive verbs referring to the direction of impulse, e.g. avoid 'an impulse signals to the CNS'. This will help to remove these words in any context (verb or noun). Concentrate on using words e.g. transmitted, propagated. This should help candidates to disconnect the use of signals and messages when describing any aspect of nerve transmission.

Key

Misconception

(?)

Question 1 (a) (iv)

(iv) The Advance Notice discusses oligodendrocytes, which are cells found only in the central nervous system (CNS).

State the name of the cells that perform a function equivalent to oligodendrocytes in the peripheral nervous system.

.... [1]

Generally, well answered although many candidates stated glial cells. There were a few NR for this question part.

Question 1 (b) (i)

(b) Treatment of injuries to the spinal cord, including with stem cell therapy, requires surgeons to determine the exact location and extent of the injury.

    (i) State the name of an imaging technique that could be used for this purpose.

        .... **[1]**

Question 1 (b) (ii)

    (ii) Describe how the technique you have given in **(i)** can be used to help surgeons to assess the location and extent of injury.

        ....

        ....

        ....

        .... **[3]**

Most candidates described MRI and recalled the use of a magnetic field and radio-waves to produce an image. Those who described a CT scan successfully recalled the use of X-rays and producing a 3D image.

(?) Candidates described the resultant images as showing damaged areas, as if the whole image would focus only on areas of injury. It should be demonstrated that images would show damaged areas compared to surrounding healthy tissue. Many images can be found that illustrate small areas of damage compared to surrounding tissue. Videos can also be shown that can be in any context e.g. herniated disc, as it serves to illustrate the relevance and limitations of these techniques.

https://www.bing.com/videos/search?q=herniated+disc+mri&view=detail&mid=26378AD9C02AB6505D1B26378AD9C02AB6505D1B&FORM=VIRE

Question 1 (c)

(c) The Advance Notice article describes several types of stem cell.

Stem cells can be classified as totipotent, pluripotent, and multipotent.

Suggest which of these types of stem cell have been used in the clinical trials described in the Advance Notice. Give reasons for your choice.

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.... **[3]**

Well answered with most candidates clearly extracting relevant information from the Advance Notice article. Marks were lost for confusing pluripotent with totipotent stem cells.

(?) As both pluripotent and totipotent stem cells derive from embryos and can differentiate into any type of cell, candidates confuse the terms and focus on totipotent stem cells. It should be emphasised that the medical use of stem cells use pluripotent stem cells that are also called embryonic stem cells or ESC's.

Question 1 (d)

(d)* Using information from the Advance Notice, evaluate the risks, benefits and ethical issues related to the use of stem cells in the treatment of spinal cord injury (SCI).

In your answer, you should demonstrate an understanding of the current and future potential of stem cell therapy.

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.... **[6]**

Well answered with most candidates covering all aspects of ethical risks, benefits and potential future benefit. Many candidates had learned about the use and potential of induced pluripotent stem cells (iPSCs). Some candidates used up too much space (and time) discussing ethical issues in terms of playing god, embryos can't give consent, etc. without mentioning the obvious fact that producing embryonic stem cells usually means destroying an embryo. Candidates often lost marks for failing to appreciate the future potential of stem cell therapy.

Exemplar 1

The benefits of using stem cells in the treatment of spinal cord injuries are that they may be able to treat the spinal cord injury, restoring function and feeling to affected areas, by regenerating axons, replace lost myelin, and protect the cord from spreading the damage after injury. Hence the financial, social, physical and psychological burdens on the patients with the injury will be reduced and hopefully removed. These financial, social and psychological burdens also affect the patients family, thereby using stem cells to treat the patients spinal cord injury you are also helping their family and support system. The risks associated with stem cell use are that the stem cells may induce tumours in the patients, the tumours are known as teromas. Another risk is with the use of stem cells in the patient the patient may have to take low level immunosuppression medication which may leave them vulnerable to opportunistic infections eg. tuberculosis. The ethical [6] issues associated with the use of stem cells for spinal cord injuries are that if the stem cells used are from human embryos some people believe this is wrong, as you are destroying a potential human life, while others believe the embryo is simply a ball of undifferentiated cells lacking human qualities. Also some people worry that using stem cells in any medicine may lead to the cloning of humans or that people may modify human behaviour.

Also stem cells in the future can be used to test drugs which could help treat diseases such as spinal cord injuries in vitro rather than in the patient

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Good use of all available space on page. Clearly moves through ethical benefits, risks and potential for future benefit. There was good discussion of each, with no focus on any particular component and always related to SCI.

Question 2 (a)

2   In 1908, American plant breeder George F. Freeman published a paper called 'A method for the quantitative determination of transpiration in plants'. Freeman was working on breeding drought-resistant varieties of alfalfa. He reasoned that individual plants with the lowest rates of transpiration would show greatest drought resistance and should be used in selective breeding.

The rate of transpiration can be measured by using:
- a potometer with a shoot cut from the plant
- a whole plant growing in a pot, where water loss is calculated by measuring loss of mass.

Freeman investigated whether results obtained using a potometer were comparable with those obtained with whole plants. He measured the rate of transpiration in four types of plant by using either a potometer with cut shoots or whole plants growing in pots. The results are shown in Table 2.1.

Item removed due to third party copyright restrictions

Table 2.1

(a) Complete Table 2.1 by calculating the missing percentages for Coleus and Portulaca.

Show your working.

[1]

This was well answered with the majority of candidates achieving the mark. The most common error was failure to express the values to three significant figures, in line with the rest of the results in the table of data.

Question 2 (b) (i)

(b) (i) Temperature was controlled in this experiment. State **two** other variables that should be controlled to ensure valid results in this experiment.

1 ....

2 ....

[2]

This was well answered with candidates clearly focusing on the main factors that have an effect on the rate of transpiration. There were general controlled variable answers like pH, so candidates could be reminded of the 'washing line' principle for factors that speed up the rate of transpiration.

Question 2 (b) (ii)

(ii) Freeman made the following conclusions:

  • There is a large difference between the rate of transpiration of a plant growing on its own roots ('normal' transpiration) and that of a cut shoot of the same plant placed in water.

  • The difference is greatest in those plants having the highest rate of 'normal' transpiration.

Does the data in Table 2.1 support Freeman's conclusions? Give reasons for your answer.

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.... **[3]**

Candidates struggled to interpret the data in order to support (or not) Freeman's conclusions. Candidates visibly separated the two conclusions and made it clear which conclusion they were discussing but kept referring to large differences as stated in the stem of the question. Candidates did not interpret the difference to the data headings in the table becoming particularly confused with the relevance of the % column. It may have helped candidates to label the data referring to pots as 'a' and data referring to potometers as 'b', labelled in the table. This would have avoided answers where it was not clear whether candidates were discussing transpiration from plants in pots or potometers.

Question 2 (c) (i) (part one)

(c) Freeman then designed an experiment to allow him to measure the rate of transpiration in an alfalfa plant growing in soil in a greenhouse. Fig. 2 shows the apparatus he used.
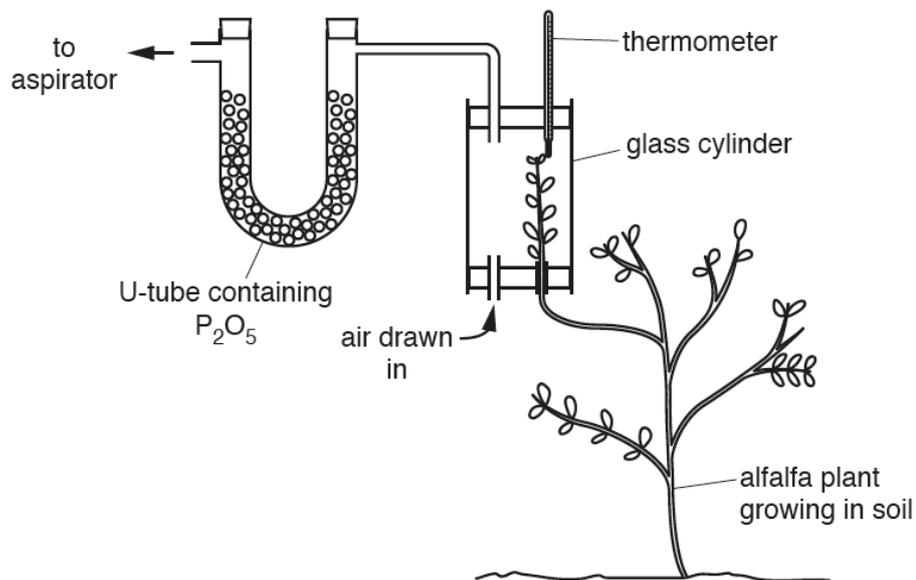
Fig. 2

The aspirator created a steady flow of air into the cylinder past the stem of the alfalfa and through the U-tube. Phosphorous pentoxide (P_2O_5) absorbed any water in the air flowing through the U-tube. The mass of the U-tube was measured at ten minute intervals for one hour in order to calculate the rate of transpiration.

Question 2 (c) (i) (part two)

The results of one experiment are shown in Table 2.2.

Time (min)	Increase in mass of U-tube (mg)
0	0
10	65
20	120
30	184
40	255
50	309
60	379

Table 2.2

(i) Plot a graph of the results in Table 2.2 on the grid below.

[3]
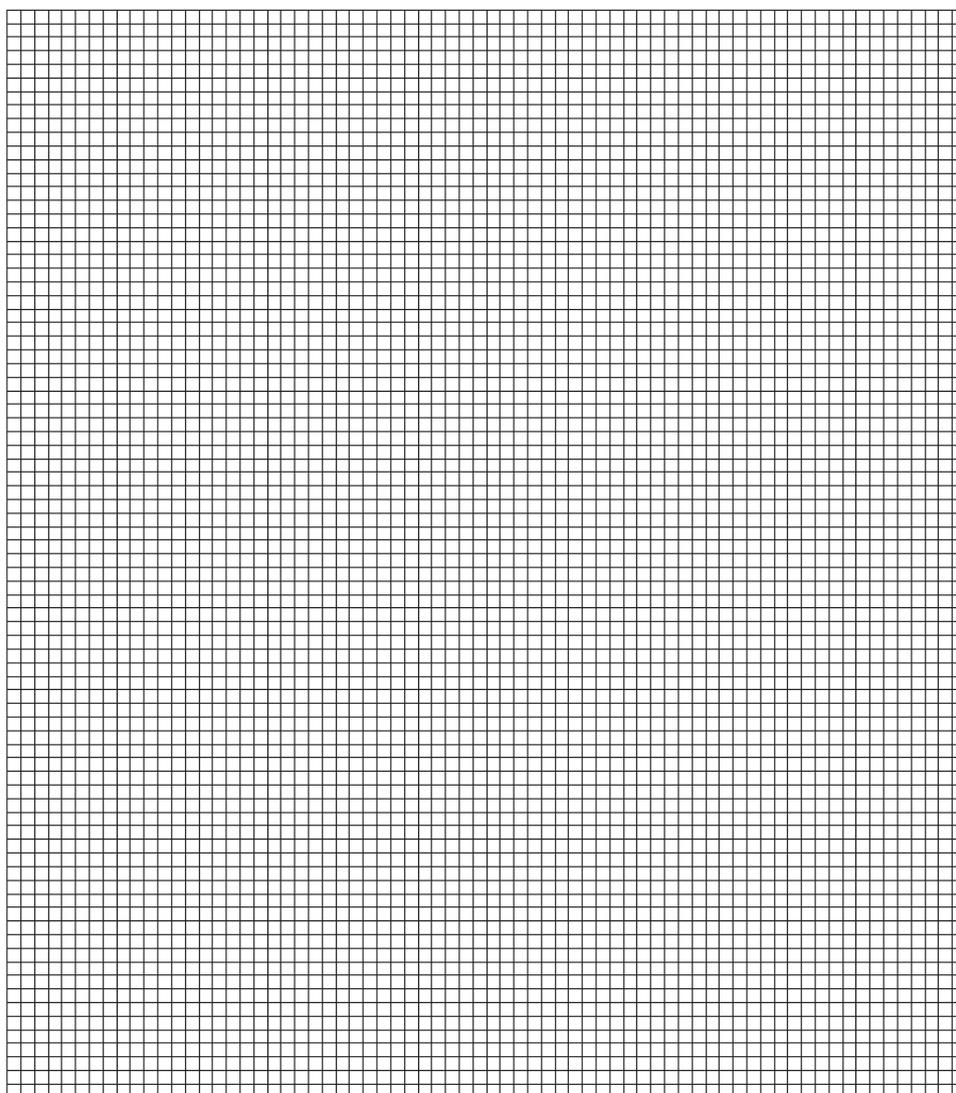
This was well answered with few candidates incorrectly labelling the x and y axis. Data points were clearly plotted with small crosses. Marks were lost with candidates not plotting the zero data points. It should be stressed that all values in a table should be plotted and a line of best fit should pass through as many data points as possible.

Question 2 (c) (ii)

(ii) The total area of leaves inside the cylinder was $22.28\,cm^2$. Use this value and your graph to calculate the rate of transpiration.

Give your answer in standard form to **two** decimal places.

answer = ... units = ... [3]

Candidates struggled to correctly obtain a gradient from the graph but did follow through their answer correctly to obtain appropriate units. Many candidates struggled to write their answer in the required format and did not seem to appreciate the meaning of the term standard form.

(i) There are tutorials and quizzes to assist with obtaining gradients:

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m3-graphs/

and for writing answers in standard form:

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/

Key

OCR support

(i)

Question 2 (d) (i)

(d) Freeman was working on developing drought-resistant varieties of alfalfa using selective breeding, but this has proved difficult.

Drought resistance depends on the ability to withstand several abiotic factors, such as high temperatures and high light intensity.

(i) Use your knowledge of inheritance to suggest why it is difficult to study the genetic basis of drought resistance.

....

....

....

.... **[2]**

Some candidates were able to appreciate the polygenic aspect of drought resistance and successfully linked the information in the stem of the question with genes and inheritance. Many candidates did not recognise the relevance of 'inheritance' and 'genetic basis' in the stem of the question and discussed their answers in terms of phenotype only e.g. not many plants survive, so there are very few that can be studied.

Question 2 (d) (ii)

(ii) Alleles of the *miRNA 156* gene regulate a group of transcription factors in alfalfa. These transcription factors activate or inhibit promoters that control genes related to drought resistance.

Explain how the *miRNA 156* gene could be used to investigate the genetic basis of drought resistance.

....

....

....

.... **[2]**

Candidates struggled to understand the relevance of the miRNA gene and confused this with RNA. However, many candidates did discuss knocking out miRNA to observe the phenotype and so exhibited a good understanding of knockout technology.

Question 2 (d) (iii)

(iii) Scientists have made a plasmid that produces more of the *miRNA 156* gene product than normal and want to use this to develop a drought-resistant alfalfa plant.

Explain how they could incorporate the plasmid into alfalfa cells.

....

....

....

.... **[2]**

Few candidates scored full marks. Those that scored one mark usually referred to a gene gun for insertion of the plasmid. Most candidates did not appreciate that the alfalfa would be insertion into plant cells and referred to vectors relevant to animal cells e.g. viruses. There were a lot of descriptions using restriction enzymes and ligases to obtain the recombinant plasmid, not realising the focus of the question was on the incorporation of the plasmid.

Question 3 (a) (i)

3 (a) The NHS has published the following advice about tuberculosis (TB) on its website:

> If you're diagnosed with active pulmonary TB (TB that affects your lungs and causes symptoms), you will be given a six-month course of a combination of antibiotics. The usual course of treatment is:
>
> - two antibiotics (isoniazid and rifampicin) for six months
> - two additional antibiotics (pyrazinamide and ethambutol) for the first two months
>
> It is important to take some basic precautions to stop TB spreading to your family and friends. You should:
>
> - always cover your mouth – preferably with a disposable tissue – when coughing, sneezing or laughing
> - open windows when possible to ensure a good supply of fresh air in the areas where you spend time
> - not sleep in the same room as other people.

(i) State the name of one organism that causes TB.

.... **[1]**

Candidates struggled with this recall question. Some candidates confused the pathogen with possible vectors e.g. cows, bats and badgers. Spelling was erratic and the correct order of genus and species was rarely given.

Classification and the binomial nomenclature can be explored using Top Trump® cards e.g. predators. The genus and species are stated for each card and candidates can have fun trying to pronounce the Latin names as well as playing the game. It will help to reinforce the order in which genus and species must be written, the capital and lower-case lettering and the importance of spelling.

Biological prefixes can also be highlighted where relevant in the course content. Discussions of the prefix 'myco', the Latin for fungus, will help to prevent the use of prefixes that have completely different meanings e.g. 'myo' and 'micro'.

Many different Latin, scientific prefixes can be found at:
https://www.quia.com/files/quia/users/glysdi/Word/APBio/LatinVocab

Question 3 (a) (ii)

(ii) Explain why patients with pulmonary TB are advised to cover their mouths when coughing, to open windows when possible and not sleep in the same room as other people.

....

....

....

.... **[2]**

This was well answered for 1 mark, with candidates clearly recalling how TB is spread. Few candidates were able to separate the three pieces of advice to three different aspects of the spread of TB.

Question 3 (a) (iii)

(iii) Most bacterial infections are treated with a single antibiotic for 7–10 days.

Explain why TB requires treatment with a combination of antibiotics for a much longer period.

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....

.... **[2]**

Well answered with most candidates appreciating the antibiotic resistant possibilities of TB. Some candidates discussed the use of many antibiotics in terms of becoming infected with multiple strains of TB. Few candidates wrote about the difficulty of antibiotics to access mycobacterium, with very few mentioning tubercles or macrophages.

There are some good images of tubercles in lungs to help illustrate the damaging effects these would have on surface area for inhalation as well as a visual illustration of how well mycobacterium can 'hide' from the circulating immune cells.

http://www.pathologylearningcentre.uct.ac.za/sites/default/files/image_tool/images/408/primary-pulmonary-tuberculosis.013.jpg

Question 3 (b) (i)

(b) Fig. 3 shows the structure of the human immunodeficiency virus (HIV).
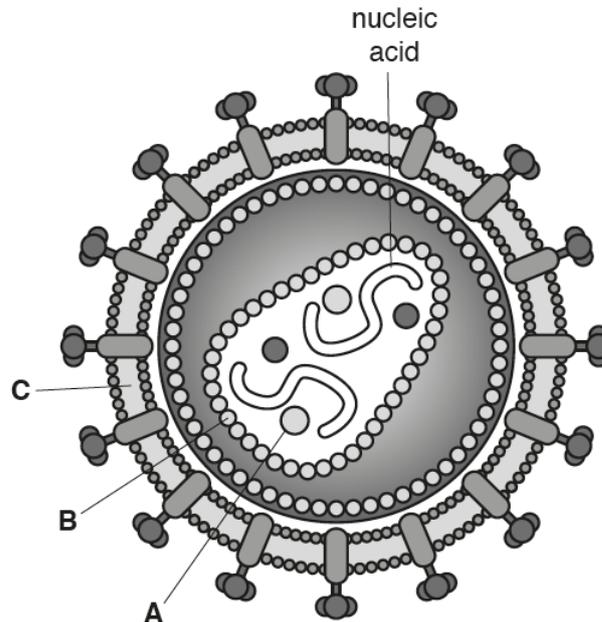
Fig. 3

(i) State the type of nucleic acid that forms the genetic material of HIV.

.... **[1]**

Well answered with only a few candidates stating DNA or ribose.

Question 3 (b) (ii)

(ii) Identify the structures labelled **B** and **C** in Fig. 3.

B ....

C ....

[1]

Candidates struggled to identify structure B. Some candidates referred to B as various organelles e.g. nucleus, which suggests a lack of appreciation as to the acellular nature of viruses.

Question 3 (b) (iii)

(iii) State the name and describe the function of the enzyme labelled **A** in Fig. 3.

name ....

function ....

....

....

[2]

Many candidates correctly stated reverse transcriptase and followed through with a correct function. Some candidates that did name transcriptase confused the function and stated the conversion of DNA to RNA. No candidates referred to integrase.

◯ Integrase has been a 'molecule of the month' and details can be found at:

http://pdb101.rcsb.org/motm/135

Question 3 (c) (i)

(c) Acquired immunodeficiency syndrome (AIDS) refers to a series of symptoms and illnesses caused by HIV.

Describe how the life cycle and method of infection of HIV explains the following features of HIV/AIDS.

(i) There can be a long period (up to ten years) between infection and the onset of symptoms.

....

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.... [2]

Few candidates understood the relevance of HIV as a latent virus. Most answers discussed the time delay in infecting lots of cells and slowly reducing the cells' functions.

◯ The integration of the viral cDNA into the host chromosomes can be easily demonstrated using pipe cleaners of different colours or there are some videos to show this integration;

https://www.bing.com/videos/search?q=latent+viruses&&view=detail&mid=BC73F1B8F6F2112B9ECBB C73F1B8F6F2112B9ECB&&FORM=VDRVRV

Other viruses could be discussed in this context, particularly in terms of herpes simplex virus which may give a more familiar context

http://www.virology.ws/2009/04/03/how-herpes-simplex-virus-exits-latency/

Question 3 (c) (ii)

(ii) A person infected with HIV becomes more susceptible to infections such as candidiasis, pneumonia and TB.

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....

.... **[2]**

All candidates appreciated that the susceptibility is due to a weakened immune system. Many candidates did relate this weakness to a decline in T helper cells, although some candidates discussed this in terms of macrophages becoming infected.

Question 3 (d)

(d) Studies have shown that HIV might increase the probability of clots forming inside blood vessels.

A student wrote the following notes about the process of blood clotting.

Complete the gaps in the student's notes using the most appropriate word or term.

Most clotting factors are ……………………………………………………… that convert an inactive

clotting factor into an active clotting factor. For example, …………………………………………………

converts prothrombin to thrombin, which then hydrolyses …………………………………………………

to form the protein fibrin. Because fibrin is a ……………………………………………… protein the

molecules become entangled with red blood cells and form a clot.

[4]

This was well answered with 'fibrinogen' and 'fibrous' the most common, correct answers.

Question 4 (a) (i)

4 (a) Physiological ageing leads to changes in the male reproductive system. These changes can cause infertility and erectile dysfunction.

(i) Explain the difference between male infertility and erectile dysfunction.

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....

.... **[2]**

This was well answered with the majority of candidates correctly describing both. Some candidates described male infertility as not fertilising an egg which did not discount the possibility of it being an egg dysfunction.

Question 4 (a) (ii)

(ii) State one factor, other than physiological ageing, that can cause erectile dysfunction.

.... [1]

This was well answered although many answers centred around the idea of temporary dysfunction.

Question 4 (b) (i)

(b) Hormone replacement therapy (HRT) is used to treat the symptoms of the menopause in some women. However, the molecules used in HRT can cause side effects.

Fig. 4 shows the results of a study, published in 2002, of the effect of HRT on the incidence of various conditions.

Item removed due to third party copyright restrictions

Fig. 4

(i) Use Fig. 4 to assess the effect of HRT on the incidence of disease and injury.

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.... [3]

This was well answered with most candidates scoring a mark for the increased risk with CHD, stroke and breast cancer. Some candidates that did recognise the difference between the placebo and the hip fracture/ colorectal cancer did not appreciate that this meant a reduced risk, merely discussing in terms of 'lower than placebo'. Very few candidates discussed error bars. Candidates should associate bar charts with the need for error bars to represent true differences (or not).

Question 4 (b) (ii)

(ii)* In November 2015 the National Institute for Health and Care Excellence (NICE) issued new guidelines for managing the menopause. These included:

- Women with cardiovascular risk factors should not automatically be excluded from taking HRT.

- Oestrogen-only HRT causes little or no increase in the incidence of breast cancer; HRT with oestrogen and progesterone can increase incidence of breast cancer, but any increased risk reduces after stopping HRT.

Use your own knowledge and these new guidelines to evaluate the risks of HRT.

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.... [6]

This was well answered with most candidates discussing both cardiovascular and cancer risks. The changes due to the new guidelines were poorly integrated into the risks, with candidates often arguing against these new guidelines and thus not realising the relevance of NICE and the evidence that would have accrued to put forward the new guidelines.

Question 5 (a) (i)

5   (a)   Fig. 5.1 shows the changes in population, annual birth rate and annual death rate in Europe and Africa since 1950 and projected beyond 2080.

Item removed due to third party copyright restrictions

Fig. 5.1

(i)   Explain why birth rates and death rates are shown in Fig. 5.1 as 'number per thousand per year'.

....

.... [1]

Most candidates discussed this terminology in terms of producing smaller numbers for ease of comparison or not being able to count every member of a population.

Question 5 (a) (ii)

(ii) Use the data in Fig. 5.1 to calculate the projected rate of increase in the population of Africa between 2028 and 2080.

Show your working. Give your answer in standard form to **one** decimal place.

answer = ... thousands year^{-1} **[3]**

This was well answered with most candidates using a population increase of 2000 000. As seen previously, candidates struggled to express their correct answers in standard form.

Question 5 (a) (iii)

(iii) Use the birth rate and death rate data in Fig. 5.1 to explain the different trends in population for Africa and Europe.

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....

.... **[3]**

Although candidates discussed birth and death rates, few appreciated the relevance of these to the overall trend in the populations of the two continents. Thus candidates did not gain marks as they did not connect their detailed description of e.g. death rates over time, to the overall population growth.

The use of acetates can help with building up graphical information. Students can place an acetate over the detailed graph and sketch one line only and describe (and explain) that line. Each candidate can sketch a different line and then work in groups and add the lines together by placing the acetates on top of each other. This will eventually build up to the original graph, but having interpreted and described each line first.

Question 5 (b) (i)

(b) Fig. 5.2 shows the total cereal production in Africa and cereal imports into Africa in the period 1960–2010.

Item removed due to third party copyright restrictions

Fig. 5.2

(i) Explain why cereals are staple foods in many African countries.

....

....

....

.... **[2]**

Few candidates appreciated that cereals are a good source of carbohydrates and could be used to make other foods. Most candidates stated cereals cope well with the climate but did not appreciate it would be their growth in a hot climate.

Question 5 (b) (ii)

(ii) Discuss to what extent the data in Fig. 5.2 explain the changes in death rates in Africa shown in Fig. 5.1.

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.... **[2]**

The majority of candidates correctly related the increase in cereals to the decrease in death rates to gain mark points 1 and 2.

Question 5 (c)

(c) Using Fig. 5.1 and Fig. 5.2, as well as your own knowledge, what can you conclude about the potential risks to food security and sustainability in Africa?

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.... **[5]**

Candidates struggled to answer this question with some clearly not understanding the meaning of food security, whilst others did not relate their knowledge of food security to the figures and the increase in the population. Very few candidates quoted the meaning of food security to gain a mark. Many candidates discussed an increased risk to food security in terms of climate change and natural disasters.

Exemplar 3

Although food supply, with greater production and import, is increasing over time, the demand for food, with rising population, is also increasing and at a greater rate. ✓ Specifically if this continues, where to they might not be (It is not sustainable) ✓ able to meet the current demands without compromising the ability of the future generation to meet this. This is because in order to meet rising food demands, farmers will turn to monoculture ✓ to increase yield or overfishing, which would deplete fish source. In the long term, monoculture will result in soil degradation as all of the nutrients are used up. Thus, in the future, there might not (e.g. nitrate) be enough food to meet demand as crop production might not increase unless at a greater rate than population increase. Climate change will also make environment harsher for crop growth. Therefore unless sustainable method, e.g. crop rotation are used, it is not sustainable. ✓

[5]

This exemplar shows recognition of relevance to increasing population at the start and a clear understanding of risk to food security, and relating reliance on crops to monoculture and lack of biodiversity.

Question 6 (a) (i)

6   The hormone erythropoietin (EPO) is produced by the kidneys.

   (a) (i)   Which cells in the body are targeted by EPO?

   .... [1]

Question 6 (a) (ii)

   (ii)   What change in conditions within the body would lead to an increase in the production of EPO?

   .... [1]

Well answered for both. Some candidates stated red blood cells for (i) and gave a range of unusual conditions for (ii), including water potential and red blood cell count.

Question 6 (b) (i)

   (b)   EPO can now be produced using recombinant DNA methods. The product is called rhEPO and has been used by athletes to enhance performance. This 'blood doping' has been banned since the early 1990s and anti-doping agencies have used a combination of blood and urine tests to detect the illicit use of rhEPO.

   (i)   Suggest how the use of rhEPO can be detected in a blood sample.

   ....

   ....

   ....

   ....

   .... [2]

This was well answered with many candidates stating the use of haemocytometers for counting red blood cells. A number of candidates thought that the presence of rhEPO could be detected by the presence in the blood of recombinant DNA coding for rhEPO, or even recombinant plasmids. A few candidates suggested using a Biuret test, so although they appreciated EPO was a protein, they did realise this would detect all blood proteins.

Question 6 (b) (ii)

(ii) Suggest why it has been difficult to determine the illicit use of rhEPO in the past.

....

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.... **[2]**

> The majority of candidates did not appreciate the presence of normal EPO as well as rhEPO and thus could not compare the structures of the two. Most answers discussed the limitations in methods available in the past.

Question 6 (c) (i)

(c) Patients who suffer from chronic kidney disease (CKD) often develop anaemia, the blood disorder that can occur when the body has fewer erythrocytes than normal.

(i) rhEPO can be used in the treatment of anaemia.

Explain why the normal action of EPO in the body makes it useful as a treatment for anaemia.

....

.... **[1]**

> This was well answered with only a few candidates answering solely in terms of anaemia as an iron deficiency.

Question 6 (c) (ii)

(ii) Suggest why CKD patients often develop anaemia.

....

....

....

....

.... **[2]**

> Candidates that connected CKD with EPO production scored mark points 1 and 2. Those who did not answer in the context of EPO did appreciate the possible dysfunctional filtration of the kidney leading to red blood cells in the urine. A few candidates discussed the release of toxins into the blood that would damage red blood cells e.g. urea.

Question 6 (c) (iii)

(iii) CKD can also trigger cardiovascular disease.

Explain how.

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.... **[3]**

Most candidates appreciated this would lead to hypertension. Some candidates did recall the increased production of renin but rarely followed through with discussion of the reaction it catalyses. Few candidates were able to describe a damaged endothelium or artery wall, merely stating that hypertension would lead to a heart attack.

Question 6 (c) (iv)

(iv) Darbepoetin alfa can also be used to treat CKD. It is a molecule with a similar structure to rhEPO.

Researchers injected a group of CKD patients with either darbepoetin alfa or rhEPO. They measured the concentration of each drug in patients' blood for up to 96 hours after injection.

Their results are shown in Fig. 6.
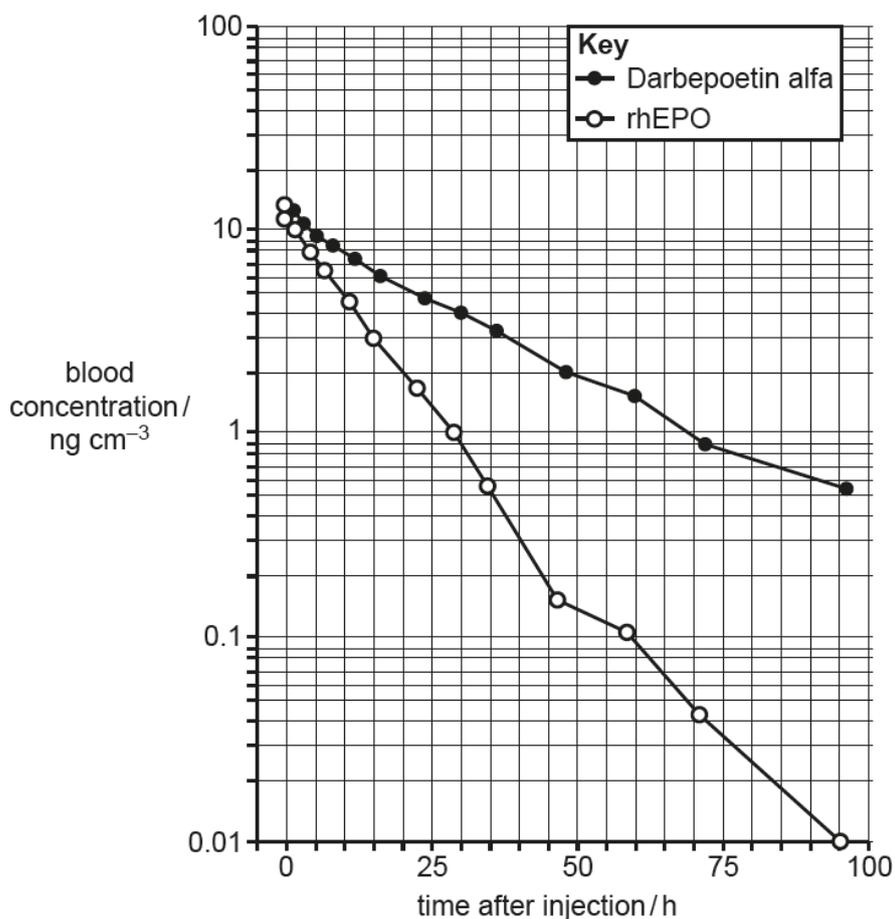
Fig. 6

A student looking at Fig. 6 stated:

After one day, there is five times more darbepoetin alfa than rhEPO remaining in the blood of patients.

Use Fig. 6 to calculate whether the student's statement is correct.

.... **[2]**

Many candidates struggled with interpreting the log scale to obtain the correct data for darboepoetin alfa and rhEPO, although most candidates were able to correctly compare their answers (correct or incorrect) in terms of a times increase or decrease.

(i) There are quizzes and tutorials to help with interpreting log scales:

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m1-handling-data/

Question 6 (d)

(d) CKD patients that develop kidney failure can be treated by dialysis, but this is not a cure. A kidney transplant can remove the need for dialysis. However, transplantation carries the risk of rejection of the transplanted kidney.

Describe how it might be possible to overcome rejection of a transplanted kidney in the future.

....

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....

.... **[3]**

This was well answered for at least 1 mark with most candidates suggesting using patients own stem cells. Many candidates discussed growing whole kidneys without appreciating the need to differentiate into cells then tissues first. Many candidates just discussed immunosuppression without relating it to a future advance.

Please note that all links were functional at the time of publication.

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Question 3a

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