Pearson

Examiners' Report
June 2017

IAL Biology 5 WBI05 01

ResultsPlus

edexcel

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

ResultsPlus

Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus.
Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2017

Publications Code WBI05_01_1706_ER

Introduction

Candidates were able to attempt the majority of questions on this paper and demonstarate their knowledge and understanding of a wide variety of topics and different skills. Most seemed to have studied the pre-release article and were able to relate their reading to questions in a meaningful manner. They seemed to manage time well, indicated by few blank spaces and later questions were equally attempted. Incorrect interpretatation of wording was minimal and only seen for particular questions. A satisfying number were able to relate their knowledge to unfamiliar scenarios, though not as well as the equivalent paper last June. This higher level of challenge is borne out in the lowering of the A and E grade boundaries this June. Questions requiring mathematical skills were generally well attempted. A small number of candidates still simply repeat the stem of the question in an attempt to gain marks, wasting space and time. Knowlege of the experimental method was pleasing, as was the theoretical recall of more challenging specification points.

Question 1 (b)

This question related neurotransmitters to ill health - many candidates correctly stated that serotonin is a neurotransmitter and when imbalanced causes depression for 1 mark. Fewer candidates stated that it was specifically a LACK of it to gain 2 marks

(b) Certain brain chemicals are essential for good health.

Explain how an imbalance of the brain chemical serotonin can contribute to ill health.

(2)

Serotonin is a neurotransmitter responsible for feelings of happiness and wellbeing. Too little serotonin can lead to disorders such as depression.

ResultsPlus
Examiner Comments
A good answer for 2marks

Question 1 (c)

Straightforward AO1 recall question to distinguish nature from nurture.

(c) Twin studies have helped scientists gain a better understanding of the contribution made by nature and by nurture to brain development.

Distinguish between nature and nurture.

(2)

A characteristic that occurs due to nature is caused by the information in the genes of a person, whereas a characteristic due to nature is caused by the influence of the environment on the person.

(Total for Question 1 = 7 marks)

ResultsPlus
Examiner Comments
This candidate gives nature links to genes and nurture to the environment for 2 marks.

(c) Twin studies have helped scientists gain a better understanding of the contribution made by nature and by nurture to brain development.

Distinguish between nature and nurture.

(2)

Nature is the ~~genes~~ features of a person that are only controlled by genes, nurture is contribution of genes and environmental factors to affect an organisms characteristics.

ResultsPlus
Examiner Comments

Mark point 2 negated so 1 mark only

ResultsPlus
Examiner Tip

Candidates should read the questions carefully.

Question 2 (a)

This was another recall question asking for 2 biotic factors affecting morphine production in poppies for 2 marks.

Scientists have recently genetically modified yeast cells to produce morphine in the controlled conditions of a laboratory.

(a) Suggest **two** biotic factors that could affect the production of morphine by poppy plants grown in fields.

(2)

Parasites in the field can ~~cause disease~~ weaken the poppy plants by causing diseases and reduce its production of morphine. other plants grown in the field could succeshully ^compete for resources such as water and grow, decreasing the number of poppies grow and thus morphine produced.

ResultsPlus
Examiner Comments
This candidate gained 2 marks for giving parasites, disease and competition.

Scientists have recently genetically modified yeast cells to produce morphine in the controlled conditions of a laboratory.

(a) Suggest **two** biotic factors that could affect the production of morphine by poppy plants grown in fields.

(2)

One biotic factor that could effect the production of morphine is the volume of water that they receive, and also the temperature they are surrounded.

ResultsPlus
Examiner Comments
This candidate incorrectly states 2 ABIOTIC factors so scores 0.

ResultsPlus
Examiner Tip
Candidates are advised to read the stem carefully.

Question 2 (c)

Morphine decreases sensitivity to carbon dioxide concentrated in the blood and a high dose may cause death. Candidates were asked to suggest a mechanism for this for 4 marks.

(c) Morphine reduces the sensitivity of the brain to the concentration of carbon dioxide in the blood.

This affects breathing rate and can cause death.

Suggest why a high dose of morphine can cause death.

(4)

If the brain does not detect the ~~p~~ fall in pH due to an increase of CO_2 in the blood, which ~~is~~ ~~of~~ should be detected by the chemoreceptors in the aorta and sent to the ~~cecdi~~ medulla, no impulses through the sympathetic nerve will be sent to the lungs to breathe faster. Therefore, the pH in blood will keep ~~increasing~~ decreasing and the intake of oxygen decreasing so enzymes will be denatured due to low pH and insufficient oxygen will be available for ~~respiration~~ aerobic respiration in the mitochondria, leading to death due to lack of ATP.

ResultsPlus
Examiner Comments

This candidate gave a good answer for 3 marks.

(c) Morphine reduces the sensitivity of the brain to the concentration of carbon dioxide in the blood.

This affects breathing rate and can cause death.

Suggest why a high dose of morphine can cause death.

(4)

If the brain is not sensitive enough to the concentration of carbon dioxide in the blood it means that an increase in blood CO_2 levels will not lead to an increase in ventilation rate (which would normally occur) thus the CO_2 will not be removed from the blood. This also means that not enough oxygen will be available if ventilation rate is not increased and as such, aerobic respiration will not occur (or will atleast decrease) and as such ATP energy will not be produced and suplied to where it is required.

ResultsPlus
Examiner Comments

This candidate did not relate a high CO2 concentration to the nervous system and muscles, but referred to respiration and a lack of ATP and therefore energy being responsible for death. This was a fairly common misconception and was awarded only 1 mark.

ResultsPlus
Examiner Tip

Candidates should read the question carefully and plan out an answer.

Question 3 (a)

This question was about phytochromes, Pr and Pfr, and their relative levels in the light and dark as shown on a flow chart in the stem of the question. Candidates were asked to explain why shoots grown in the dark are taller than those grown in the light for 4 marks.

(a) Use this information, and the diagram, to explain why plant shoots grown in the dark are taller than plant shoots grown in the light.

(4)

In dark P_{fr} will slowly convert to P_r. The ~~re~~ decreasing concentration of P_{fr} causes an increase in levels of auxin (IAA) in the plant shoots, as the inhibitory effects of the P_{fr} decrease. This means more IAA is present, so ~~at~~ can diffuse to nearby cells ~~as~~ and make cell walls flexible, to allow elongation of cells ~~not~~ causing the shoots to grow taller.

ResultsPlus

Examiner Comments

This was a good answer with good biological knowledge shown for 3 marks.

(a) Use this information, and the diagram, to explain why plant shoots grown in the dark are taller than plant shoots grown in the light.

(4)

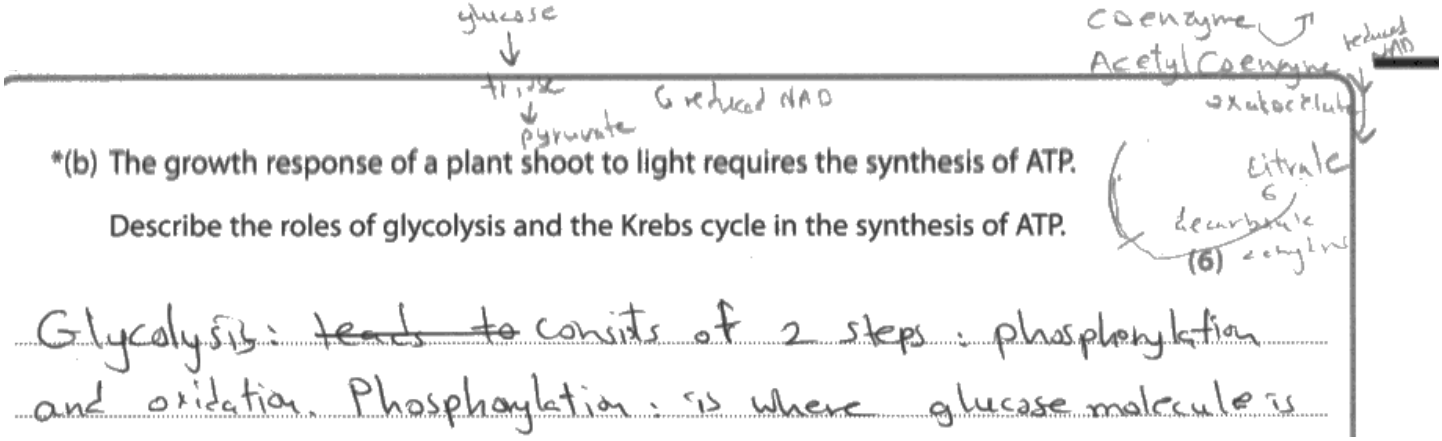
~~Pfr is~~ Pr is changed to Pfr in red light (sunlight), High levels of Pfr is associated to low levels of auxins. Auxin is a plant hormone present in the shoot and the roots of a plant that causes cell elongation; during the day there are low levels of auxin in compare to the levels of auxin present at night so plant cells are slightly longer at night however the difference is extremely small. Pfr changes to P_R in for red light.

ResultsPlus
Examiner Comments

This candidate gave a good interpretation of the information provided in the stem, but insufficient knowledge to access all 4 marks. 2 marks were given.

Question 3 (b)

This was a QWC question with emphasis on clarity of expression for 6 marks. Candidates were asked to explain the roles of both glycolysis and the Krebs cycle in the synthesis of ATP. The question was an excellent discriminator between all grades with some candidates generally telling the whole respiration story and inadvertently picking up 2 or 3 marks, usually for mentioning ATPase and chemiosmosis/oxidative phosphorylation, but others giving more detail about co-enzymes, phosphorylation of ADP and the ETC were awarded the maximum 6 marks.



*(b) The growth response of a plant shoot to light requires the synthesis of ATP.

Describe the roles of glycolysis and the Krebs cycle in the synthesis of ATP.

(6)

Glycolysis: ~~leads to~~ consists of 2 steps: phosphorylation and oxidation. Phosphorylation: is where glucose molecule is

2 inorganic phosphate from ATP to broken down to ADP. ~~and~~ Then ~~it's~~ 2 triose phosphate are oxidised to 2 pyruvate molecules leading to the production of 2 reduced NAD and 4 ATP (Net gain of 2 ATP).

Krebs Cycle: It happens twice per whole process. ~~(for each of the 2)~~ Acetyl coenzyme reacts with oxaloacetate forming citrate (coenzyme goes back to be used again to link reaction) Reduced NAD is formed. Then citrate is decarboxylated and dehydrogenated leading to the formation of 4 carbon compound 2 reduced NAD and 1 reduced FAD are formed. These reduced NAD and FAD help in the synthesis of ATP in oxidative phosphorylation where they both oxidise ~~d~~ to NAD & FAD. H^+ ions are broken down into protons and electrons. Electrons pass through ETC (Electron transporting chain) losing energy to each electron ↓ electron carrier) which is used to move protons into the intermembrane of mitochondrion to move by electrochemical gradient to matrix through ATP synthase to form ATP. Each NAD or FAD produced about 1.5 ATP.

(Total for Question 3 = 10 marks)

ResultsPlus

Examiner Comments

This was an excellent answer detailing both glycolysis and Krebs with reference to the synthesis of ATP from ADP and Pi in both.

ResultsPlus

Examiner Tip

This candidate has worked through the answer coherently and correctly split it into 2 parts as in the stem.

*(b) The growth response of a plant shoot to light requires the synthesis of ATP.

Describe the roles of glycolysis and the Krebs cycle in the synthesis of ATP.

(6)

Glycoslysis take Place in the cytoPlasm of the cell where ~~is~~ glucose is converted into phosPhorylated form by using of 1 ATP molecules. It furthere converted into Pyruvate and by reducing NAD into reduced NAD ($NADH^{+}$). Plus 1 moleules of ATP. Pyruvate is 3-C which furthure oxidise into 2-C compound by ~~emitting~~ releasing one molecules CO_2. It move into ~~mitotic~~ mitochondria ~~cristea~~ matrix where it enter into kreb's cycle by reacting ↑ acetyl. CO-enzyme and form 6-C compound. in the Presence of Oxygen. The 6-C compound is furthure oxidise by releasing 1 molecules of CO_2 and one reduced NAD. It furthure oxidise to form two reduced NAD, one reduced FAD and one ATP molecules and convert into 4-C compound.

Glucose
↓
GP
↓
Pyruvate

ResultsPlus
Examiner Comments

This candidate gained 3 marks correctly detailing parts of glycolosis and Krebs but not going into enough detail with regard to ATP synthesis.

ResultsPlus
Examiner Tip

Candidates should read questions carefully.

Question 4 (b) (i)

Answers to this question were disappointing, but distinguished well between candidates. A graph was shown giving the % decrease in muscle volume for astronauts returning from space. However, the axes were inverted and candidates struggled to translate the information provided into a concisely and correctly worded description of the changes. 31% scored 0 marks and 35% scored 2 marks maximum. The candidates' ability to manipulate data was also disappointing.

(i) Using the information in the graph, describe the changes in the volume of the gastrocnemius and soleus muscles.

(2)

percentage decrease of gastrocnemius muscles in less than soleus muscle for 4 day and 19 day after landing. There is most decrease in both muscles ~~after~~ 4 day after of landing. Then 19 days. 6% difference for gastrocnemius muscle and 6% differee also for Soleus muscles.

ResultsPlus
Examiner Comments

This candidate gave a concise answer for 2 marks.

(i) Using the information in the graph, describe the changes in the volume of the gastrocnemius and soleus muscles.

(2)

~~After landing the~~ After 4 days after landing the % decrease in muscle volume is ~~more~~ less in soleus than in gastrocnemius. In soleus it is ~~14.4%~~ 15% and in gastrocnemius is ~~10.7%~~ 11.1%. After calculating the ~~mass~~ volume of muscles 19 days after landing it is seen that again the % decrease in muscle volume is less in soleus than in gastrocnemius. In soleus it is 9.1% and in gastrocnemius it is 5.1%.

ResultsPlus

Examiner Comments

This candidate read the graph the wrong way around and miscalculated data. No marks could be given.

Question 4 (b) (ii)

This linked directly to 4bi and if candidates had incorrectly read the graph they often lost 2 marks here. They needed to link changes in MRNA levels present to muscle volume and only some candidates scored 2 marks.

(ii) The cellular levels of messenger RNA involved in the synthesis of actin change after landing on Earth.

Suggest how this might explain the change in muscle volume between 4 days and 19 days after landing on Earth.

(2)

The mRNA cellular levels increase after landing on Earth ~~after 5~~, so more transcription of actin producing gene, so more actin protein made. Due to higher levels of actin, muscle volume increase ~~after~~ 19 days after landing.

ResultsPlus
Examiner Comments

This was an excellent answer linking gene activation to transcription and translation.

(ii) The cellular levels of messenger RNA involved in the synthesis of actin change after landing on Earth.

Suggest how this might explain the change in muscle volume between 4 days and 19 days after landing on Earth.

(2)

Actin is a component of muscle. decrease in messenger RNA involved in synthesis of actin ensure that no new muscle tissues are made. Hence when muscle breaks down it is not replaced and the volume of ~~muscle~~ muscle decreases.

ResultsPlus
Examiner Comments

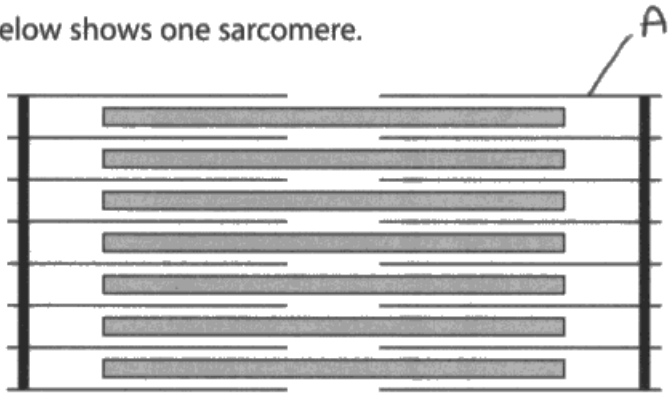
This candidate had not answered 4bi correctly so the link to 4bii was incorrect and so no marks were awarded.

Question 4 (b) (iii)

Candidates were given a diagram of a sacromere and asked to label the actin filament.

(iii) Actin is a structural protein found in the sarcomeres of a muscle fibre.

The diagram below shows one sarcomere.



Draw a line, labelled A, to show the location of actin in this sarcomere.

ResultsPlus
Examiner Comments

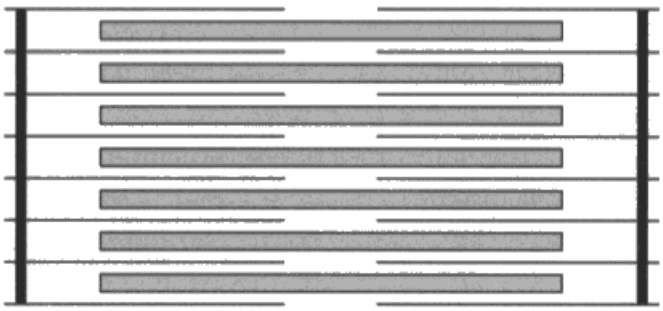
The line was clearly touching the actin filament and scored 1 mark.

ResultsPlus
Examiner Tip

The end of the label must touch the line.

(iii) Actin is a structural protein found in the sarcomeres of a muscle fibre.

The diagram below shows one sarcomere.



Draw a line, labelled A, to show the location of actin in this sarcomere.

ResultsPlus
Examiner Comments

The candidate made no attempt to insert a line.

Question 4 (b) (iv)

Candidates were asked to name two OTHER structural proteins involved in muscle contraction for one mark. This was well answered with some candidates even correctly stating all 3.

(iv) Actin has a role in muscle contraction.

Name **two** structural proteins present in a sarcomere, other than actin, that have a role in muscle contraction.

(1)

myosin, ~~tropomyosin~~, tropunin

ResultsPlus
Examiner Comments
This candidate gave 2 correct answers and 1 mark was awarded.

(iv) Actin has a role in muscle contraction.

Name **two** structural proteins present in a sarcomere, other than actin, that have a role in muscle contraction.

(1)

Myosin, ATP.

ResultsPlus
Examiner Comments
ATP is not a structural protein and therefore gained no marks.

Question 4 (c)

This was a well answered question. Candidates were told that slow twitch muscle fibres decrease by 15% in space and were asked how this affected the ability of the astronaut to carry out exercise. Many candidates gave good responses gaining a maximum of 3 marks.

(c) The transcription of genes involved in making fast twitch and slow twitch muscle fibres is affected during six months in space.

The mean percentage of slow twitch muscle fibres is reduced by 15%.

Explain how this reduction affects the ability of astronauts to carry out exercise.

(3)

Slow twitch fibres respire mainly ~~aero~~ aerobically and have a high concentration of myoglobin. If the percentage of slow twitch muscle decreases in astronaughts then they can no longer ~~exert~~ to physical activity for long periods of time because ~~if there are less less aerobic respiration~~ fast twitch fibres fatigue quickly and respire anaerobically, and they astronaughts ~~have~~ have more fast twitch than slow twitch muscles in their body after being in space. ~~there is less~~

ResultsPlus

Examiner Comments

This candidate gave low level detail gaining only 1 mark.

(c) The transcription of genes involved in making fast twitch and slow twitch muscle fibres is affected during six months in space.

The mean percentage of slow twitch muscle fibres is reduced by 15%.

Explain how this reduction affects the ability of astronauts to carry out exercise.

(3)

Slow twitch muscle fibres have more mitochondria and mainly depend on aerobic respiration to provide ATP for contraction. Since they are reduced in proportion, endurance exercises cannot be carried out effectively (which requires slow twitch muscle fibres). The astronauts would exhaust after exercising ~~from~~ for some time, due to muscle fatigue (less available ATP since less aerobic respiration and lactate buildup). They would use their fast twitch fibres more, so which carry out anaerobic respiration and useful in short bursts of exercise

(Total for Question 4 = 11 marks)

ResultsPlus

Examiner Comments

This candidate answered correctly detailing the characteristics of slow and fast twitch fibres and related this to the scenario presented in the question. A maximum 3 marks were given.

Question 5 (a)

A table of ion concentrations inside and outside of a resting neurone was provided. Candidates were asked to explain how this distribution was maintained. Potassium, sodium and anions were given. Three marks were available. The well answered questions were awarded 2 marks on average.

Explain how the distribution of these ions is maintained.

(3)

The membrane is impermeable to organic anions so none can go out of the axon. It has a K^+ and a Na^+ gate, a K^+ channel and a Na^+/K^+ pump. ~~When the~~ Na^+ ions are pumped out by the pump and when the ~~correct~~ concentration is too low, the Na^+ gates open to allow ~~se~~ Na^+ to enter. When the concentration is too high, they close and Na^+ is pumped out again. K^+ is pumped in by the pump and exits the axon through the K^+ channel across a concentration gradient.

ResultsPlus

Examiner Comments

This was a good answer including a correct explanation for all parts of the table.

Explain how the distribution of these ions is maintained.

(3)

Na+ channels are normally closed (permeability of cell to Na+ ions usually low) and K+ channels open so K+ ions can move in and out of cells while Na+ ions can not diffuse back into cells. The Na-K pump pumps 3 Na+ ions out of the cell and 2 K+ ions into the cell, using energy from ATP hydrolysis. This helps maintain the electrochemical gradient of the ions across the cell membrane. The cell's ~~its usually~~ anion channels usually are closed, ~~not permeable to anions~~ (Cl- ~~channels~~ usually closed) and ~~ions~~ anions cannot diffuse out of cell but only actively transported into the cell.

ResultsPlus

Examiner Comments

This candidate gave the correct biological detail for Na and K ions but there was a misconception about anion channels and gained 2 marks.

Explain how the distribution of these ions is maintained.

(3)

Inside the nerves potassium ions are most frequent so they are responsible for transmission of impulses in the nerve. And sodium ions are the most frequent outside which help with the impulses outside the nerve. Organic anions are most frequent around synapses which carries impulses from one neurone to another

ResultsPlus

Examiner Comments

This candidate offered no awardable content or reference to pumps/channels in the role of maintaining the resting potential.

Question 5 (b) (i)

Candidates were asked how a pesticide worked to immobilise ants. Two graphs of membrane potential across a neurone were given to help. Generally this was well interpreted and answered.

(i) Using the information in the graphs, suggest how metaflumizone makes ants immobile.

(3)

it prevents the sudden ~~p~~ drastic increase of permeability ~~of~~ of ~~Sodiu~~ the membrane to ~~Sodiu~~ Sodium ions. No Sodium ions move in, ~~it~~ Thus ~~so the no~~ the inside of the axon ~~remain~~ remain negative. No ~~electrochemical~~ depolarisation and so, no ~~a~~ action potential ~~is~~ resulting in immobility.

ResultsPlus

Examiner Comments

This was a reasonable answer scoring 2 marks.

Question 5 (b) (ii)

Ants are killed by the pesticide metaflumizone via immobilisation. Candidates were asked to suggest a valid experiment to find the minimum concentration needed. Generally this was well attempted and gave a good insight into control variables and standardisation.

(ii) Describe a valid laboratory investigation to find the minimum concentration of metaflumizone needed to make these ants immobile. contraction

(4)

- Independent variable = concentration of metaflumizone with 10 concentration used.
- Dependent variable = ~~the membrane potential~~ movement of ant distance per min.
- Control variable = Temperature, pH and age of the ants.
- Electrode will be placed on ant and ~~change~~ in putting 30 ants into 10 different group with different concentration of metaflumizone.
- For each measuring their distance per minute and using a ruler. ~~Find out~~
- Repeat the experiment 3 times ~~on~~ in standized procedure.
- Find the minimum conc ~~of~~ needed to make 0cm per minute in a graph and compare.

ResultsPlus

Examiner Comments

This was a good answer well presented in sections.

(ii) Describe a valid laboratory investigation to find the minimum concentration of metaflumizone needed to make these ants immobile. 0%, 0.5%, 1%, 1.5%, 2%, 2.5%

(4)

Collect neurones from the same ant and put ~~each~~ one in each solution of ~~me~~ different ~~meta~~ concentration of metaflumizone - 0%, 0.5%, 1%, 1.5%, 2.5%. Insert electrodes into each neurone. Stimulate each neurone using the same stimulation. Record at which concentration the neurone starts to be not depolarised. Repeat the ~~r~~ experiment and calculate the mean minimum concentration. Throughout the investigation, temperature ~~should~~ and pH should remain constant.

ResultsPlus
Examiner Comments
This answer did not contain sufficient detail.

Question 5 (b) (iii)

Candidates were asked to explain how the ants became resistant to metaflumizone, the pesticide. They generally gained only 1 mark referring to it as being a genetic mutation. Many went off on a tangent and talked about natural selection when the question was referring to protein synthesis.

(iii) Some Argentine ants are resistant to metaflumizone.

Suggest how these ants become resistant to metaflumizone.

(3)

These ants could have mutated and a new gene developed that is translated into a protein /enzyme that could break down the chemicals of the pesticide. they break down metaflumizone, or they produce other chemicals that outcompete it. Also these ants could have inhibitory neurones where the metaflumizone tends to act

ResultsPlus

Examiner Comments

This was a good answer correctly relating gene mutation to a change in protein and therefore enzyme.

(iii) Some Argentine ants are resistant to metaflumizone.

Suggest how these ants become resistant to metaflumizone.

(3)

A mutation in the gene responsible for the structure of the receptors present on their post synaptic neurons occured, as such metaflumizone could not bind to these receptors. This mutation was veiwed as beneficial and as such ~~pasta~~ passed onto other ants in order to improve their chances of survival.

ResultsPlus

Examiner Comments

Only 1 mark was awarded as the candidate related the mutation to natural selection ie survival of the fittest and the passing on of an advantageous allele.

Question 6 (b) (i)

Candidates were asked to analyse 2 line graphs showing changes in core body and skin temperature, before and after eating ice. This was well interpreted and concise descriptions were generally given.

(i) Using the information given, compare the changes in the core temperature and the skin temperature.

(2)

Core temperature is above the skin temperature by around 0.65°C until the ice is eaten. Then the core temperature rapidly drops below the skin temperature as skin also rises rapidly to reverse each other. Before the ice is eaten both the core and the skin temperature remain until ice causes change.

ResultsPlus
Examiner Comments

This was a detailed concise answer gaining 2 marks

(i) Using the information given, compare the changes in the core temperature and the skin temperature.

(2)

After eating the ice, the skin temperature increased from 36.9°C to 37.5°C while the core body temperature decreases from 37.5°C to 37.0°C

ResultsPlus
Examiner Comments

This candidate made no reference to changes occurring specifically before eating ice and therefore only scored 1 mark.

Question 6 (b) (ii)

Candidates were asked to explain the thermoregulatory mechanisms used to explain changes occurring after ice was eaten. Generally well answered but some candidates simply listed ALL of the available ones rather than concentrating on those that specifically reduce heat loss by evaporation. This was a good discriminating question.

(ii) Explain the change in heat loss by evaporation after eating the ice.

(4)

After eating the ice, core body temperature decreases significantly by around 0.58°C this decrease is detected by skin receptors and thermoreceptors in hypothalamus which send impulses via the autonomic nervous system to the heat gain centre. The heat gain centre sends impulses via the autonomic nervous system to sweat glands, reducing the production of sweat so less heat is lost by evaporation, thus this is a negative feedback mechanism to restore core body temperature levels to around 136.9°C

ResultsPlus
Examiner Comments

This was a detailed concise answer which correctly answers what it was meant to and 4 marks were awarded.

(ii) Explain the change in heat loss by evaporation after eating the ice.

(4)

- Heat loss by evaporation is a thermoregulation process which keeps the body cold by conduction.
- As the icecream reduces the core temperature by 0.5°C, it is no longe needed to loose heat by evaporation.
- So the heat lost reduces by more than half.

ResultsPlus
Examiner Comments

This answer lacked in detail and the necessary knowledge base required.

Question 6 (c)

Candidates were told that hypothermia lowers core body temperature and asked to suggest how this relates to reduced ATP synthesis. Many related this only to the enzyme function so scored only 2 for parts 1 and 7, but some candidates related it to movement of protons and the decrease in gradient and diffusion caused by a temperature decrease, gaining higher marks.

(c) Prolonged exposure to cold temperatures causes hypothermia.

Hypothermia lowers the core body temperature which reduces the rate of metabolic processes, such as chemiosmosis, in cells.

Explain how hypothermia reduces the synthesis of ATP by chemiosmosis.

(5)

If temperatures are too low, then rate of breathing and heart rate decrease. Then less supply of oxygenated blood to ~~the~~ cells then ~~less~~ of pyruvate cannot enter the Kreb's ~~of~~ cycle then ~~an~~ accumulation of 4C- compound occurs and less ~~x~~ reduced NAD produced so less ~~re~~ reduced NAD oxidized in electron transport chain ~~then~~ then less protons enter intermembrane space so less diffusion of protons through ATP se then less ATP produced by chemiosmosis (as the electrochemical gradient is less steep as ~~insufficient~~ energy is released by protons moving through ATPase)

ResultsPlus

Examiner Comments

This was an excellent answer detailing the precise mechanisms involved in a logical sequence and gained 5 marks.

(c) Prolonged exposure to cold temperatures causes hypothermia.

Hypothermia lowers the core body temperature which reduces the rate of metabolic processes, such as chemiosmosis, in cells.

Explain how hypothermia reduces the synthesis of ATP by chemiosmosis.

(5)

If the rate of chemiosmosis is reduced less electrons would pass through the electron transport chain which means less reduced NAD and reduced FAD will be formed. Converting NAD and FAD into their reduced forms releases energy as ATP therefore less ATP would be formed. Also if less NADH and FADH molecules are formed glycolysis would also slow down and ATP production will slow down with it.

ResultsPlus

Examiner Comments

This candidate gave insufficient detail gaining no awardable content marks.

Question 7 (a)

Candidates needed to state a null hypothesis, that is, AO3 content. Many used terms correlation/change/relationship instead of difference.

(a) The article states that there have been studies that have examined the use of e-cigarettes in helping people to quit smoking normal cigarettes (paragraph 8).

State a null hypothesis these studies were testing.

(1)

There is no significant difference between use of e-cigarettes and quitting smoking

ResultsPlus
Examiner Comments
The comment 'no significant difference' given gained 1 mark.

(a) The article states that there have been studies that have examined the use of e-cigarettes in helping people to quit smoking normal cigarettes (paragraph 8).

State a null hypothesis these studies were testing.

(1)

Accept the null hypothesis using 5% and 95% confidence.

ResultsPlus
Examiner Comments
This candidate gave 'accept the null hypothesis' which was insufficient for a mark.

Question 7 (b)

The candidates were provided with the detail that a study was long term/randomised/ placebo controlled. Candidates who separated these 3 components and discussed them separately achieved higher marks than answers that were vague and made unqualified reference to validity and/or reliablilty.

(b) The article states that 'the lack of long-term randomized placebo-controlled studies has been problematic' (paragraph 9).

These studies are needed to assess the effectiveness of e-cigarettes in helping people to quit smoking normal cigarettes.

Suggest why long-term randomised placebo-controlled studies are needed.

(3)

They are needed so as to see the side-effects and effectiveness of the e-cigarettes. Also it has to be placebo-controlled to reduce the psycological effects.

ResultsPlus

Examiner Comments

A reduction of psychological effects was awarded 1 mark. Side effects were not equal to long term effects.

(b) The article states that 'the lack of long-term randomized placebo-controlled studies has been problematic' (paragraph 9).

These studies are needed to assess the effectiveness of e-cigarettes in helping people to quit smoking normal cigarettes.

Suggest why long-term randomised placebo-controlled studies are needed.

(3)

Long-term randomised placebo-controlled studies are needed because they take a lot of time to show effect and the effect on every individual is different and scientists study all the different effect the placebo shows to come up with a valid conclusion.

ResultsPlus

Examiner Comments

This answer was lacking in detail as reported in the main introduction to this question.

Question 7 (c) (i)

A QWC question, with emphasis on logical sequence, was very poorly answered with only 1.8% gaining full marks and 52% scoring 0. Candidates who misinterpreted the stem were led into thinking that the mechanism of action by which nicotine stimulates the secretion of the hormone adrenaline was the same as that occurring at a synapse. Many told the whole story of neurotransmission and therefore were unable to access 4 of the 8 marks. Commonly seen were 6 and 7 marks, which made this a good discriminating question.

*(c) Nicotine is known to stimulate heart rate (paragraph 40).

(i) Nicotine increases heart rate by stimulating adrenaline secretion from cells in the adrenal gland.

The sequence of events leading to this adrenaline secretion involves a similar sequence of events that lead to the release of neurotransmitters at a synapse.

Use this information and your own knowledge to suggest how nicotine stimulates an increase in heart rate.

(6)

If there is an increase in the amount of adrenaline secreted, the heart rate of a person will be increased, as more action potentials will be occuring. Nicotine, will bind to the proteins on the post-synaptic membrane. This causes Ca^{2+} ions to enter the pre-synaptic membrane by diffusion, down the concentration gradient. As a result, Na^{+} ions diffuse over of the pre-synaptic membrane. These ions bind to the enzymes on the membrane of the post-synaptic membrane which stimulate the secretion of neurotransmitter. However, because nicotine is bound to the enzymes on the post-synaptic membrane, it does not allow for the reabsorption of the neurotransmitter. Thus, in the adrenaline which was secreted makes its way into the blood stream therefore increasing heart rate.

ResultsPlus

Examiner Comments

This candidate misinterpreted the mechanism of action as explained in the introduction above and therefore only scored 2 marks.

*(c) Nicotine is known to stimulate heart rate (paragraph 40).

(i) Nicotine increases heart rate by stimulating adrenaline secretion from cells in the adrenal gland.

The sequence of events leading to this adrenaline secretion involves a similar sequence of events that lead to the release of neurotransmitters at a synapse.

Use this information and your own knowledge to suggest how nicotine stimulates an increase in heart rate.

(6)

An impulse arrives at the pre synaptic knob of the neurone and causes Calcium (Ca^{2+}) ion channels to open on the neurone (or in this case Ca^{2+} ion channels open on the adrenal gland), this causes an influx of Ca^{2+} ions to enter the pre synaptic knob, this causes the vesicles to move and fuse with the pre synaptic membrane (so Ca^{2+} ions enter adrenal gland cells and cause vesicles containing adrenalin to move to the cell membrane), neuro transmitter is released by exocytosis (adrenaline is released by exocytosis in this case), normally the neuro transmitter diffuses across the cleft to bind to receptors on the post synaptic membrane, causing Sodium ion channels to open and Sodium ions to enter post Synaptic membrane causing a depolarisation and action potential ⟶ (in this case - adrenaline released/secreted + travels in blood until it reaches medulla oblongata in the cardiovascular centre (target cell) : binds to receptors on medulla oblongata and causes depolarisation of it by opening Sodium (Na^+) ion channels and causes the medulla oblongata to send impulses to the SAN in the heart to contract/fire more frequently (impulses sent along sympathetic nerves = noradrenaline released : SAN fires more = Heart rate increases.

ResultsPlus

Examiner Comments

This was an excellent logical high level answer correctly detailing the mechanism of action necessary to bring about a change in HR via the SAN.

Question 7 (c) (ii)

Candidates were required to explain how nicotine increases an individual's risk of atherosclerosis. Overall, this was well answered with many candidates achieving the maximum 3 marks.

(ii) The article states that nicotine increases the risk of developing atherosclerosis (paragraph 14).

Explain how nicotine increases the risk of developing atherosclerosis.

(3)

Nicotine increases heart rate so nicotine increases the blood pressure. High blood pressure can cause damage to the endothelium lining of the arteries. This causes white blood cells, Ca^{2+} and cholesterol to build up, forming an atheroma that leads to hardening of the arteries.

ResultsPlus

Examiner Comments

This was a good well witten answer and awarded 3 marks.

(ii) The article states that nicotine increases the risk of developing atherosclerosis (paragraph 14).

Explain how nicotine increases the risk of developing atherosclerosis.

(3)

Nicotine ~~or~~ increases the risk of atherosclerosis because it is related to CVD. It helps the fat get deposited in the artery of the heart formed by cholesterol. It encourages the fat deposit by rupturing the smooth lining of the artery as it gets mixed with the blood.

ResultsPlus
Examiner Comments

This candidate gave insufficient detail gaining 1 mark only.

Question 7 (d)

Candidates were asked to discuss why one experiment performed on mice might have limitations. Many referred to mice and humans being different and hence responding differently, but very few mentioned the need to repeat the experiment or include the idea that doses used are toxic to mice.

(d) Conklin stated that there are 'limitations of one experiment performed on mice' (paragraph 15).

Suggest why Conklin made this statement.

(2)

Because the effect of ecigarettes on mice might have different effects on humans so no valid ~~Conclusum~~ conclusions can be drawn. Also mice have a different ~~test~~ response to substances than humans as their body structure is not identical and animal testing has some ethical restrictions

ResultsPlus
Examiner Comments

This candidate correctly identified different responses in mice and humans gaining 1 mark.

(d) Conklin stated that there are 'limitations of one experiment performed on mice' (paragraph 15).

Suggest why Conklin made this statement.

(2)

- Mice have a different genotype than humans therefore the results cannot be fully applied to humans.
- Only one experiment shows the increased risk of developing atherosclerosis, therefore it is not very reliable. More experiments showing the same results are needed to make it reliable.

ResultsPlus
Examiner Comments

This candidate included the idea of different responses and the need to repeat them for 2 marks.

Question 7 (e)

E-cigarettes compromise immune function of macrophages. Candidates were asked how this would affect health. Most candidates gained one mark for saying it would lead to more infection but fewer gave details, for example, less phagocytosis or antigen presentation. They tended to write simply what happened under normal circumstances and did not read the question to relate to a change in macrophage activity.

(e) The article states that cinnamaldehyde-containing e-liquids 'compromise the function of immune cells such as macrophages' (paragraph 21).

Explain how reducing the function of these cells might affect the health of an e-cigarette smoker.

(3)

By reducing macrophages = reduce non-specific and specific immune response as less phagocytosis will occur = pathogens will not be destroyed as less macrophages = less phagocytosis → macrophages also acts as APC. (antigen presenting cells) to particularly T helper cells = if T helpers not activated by macrophages = no T killer cell / B cell activation = no antibody production (B cell → plasma cells + no infected body cells killed (T killer cells) so chances of infection increase = causing bad health on the smoker.

ResultsPlus
Examiner Comments

This was a detailed and fluent response.

(e) The article states that cinnamaldehyde-containing e-liquids 'compromise the function of immune cells such as macrophages' (paragraph 21).

Explain how reducing the function of these cells might affect the health of an e-cigarette smoker.

(3)

By surpressing the function of macrophages which engulf pathogens and break them down using lysozome in their vesicles, the pathogens entering the body are not engulfed or ~~fought~~ broken down thus they enter the body through the ~~end~~ lungs or cuts on the ~~sting~~ skin and infects cells in the body, when less pathogens are broken down by immunity, more enter the body thus the smoker will get sick more frequently and these pathogens might ~~be~~ develop immunity in his system.

ResultsPlus
Examiner Comments

This candidate gave insufficient detail and did not answer the question. They simply listed their knowledge of the immune system and macrophages.

ResultsPlus
Examiner Tip

Read the question carefully and plan how to write your answer.

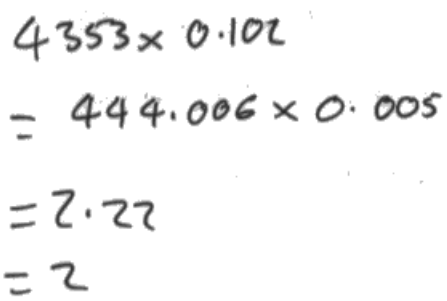
Question 7 (f)

Answers to this calculation question were disappointing with candidates picking out incorrect data and not being able to round down to a whole figure of 2 from 2.22 as the answer referred to a number of people.

(f) Using the information in paragraph 34, calculate the number of students that were aware of e-cigarettes who had actually tried e-cigarettes.

Show your working.

(2)



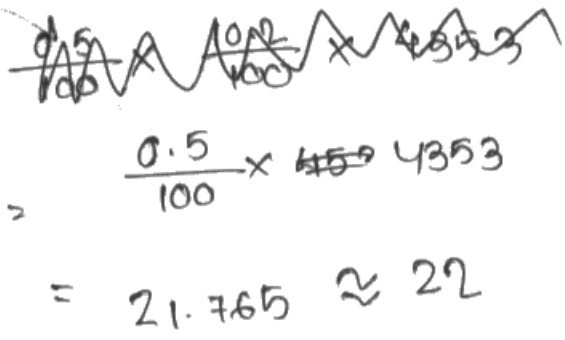
Answer 2

ResultsPlus
Examiner Comments
This candidate gave the correct answer for 2 marks.

(f) Using the information in paragraph 34, calculate the number of students that were aware of e-cigarettes who had actually tried e-cigarettes.

Show your working.

(2)



Answer 22

ResultsPlus
Examiner Comments
This candidate used incorrect figures and therefore no marks were awarded.

(f) Using the information in paragraph 34, calculate the number of students that were aware of e-cigarettes who had actually tried e-cigarettes.

Show your working.

(2)

10.2% of 4353 = ~~4355~~ 444 students.

0.5% of 4353 = 22 students

Answer 22

ResultsPlus

Examiner Comments

This candidate gained Mark point 1, but the second part of the calculation was incorrect and only 1 mark was given overall.

Question 7 (g)

This question asked why nicotine in E-cigarettes is less addictive than in burnt tobacco products and was well answered. Candidates successfully translated information in the scientific article into their answers and 3 marks were given frequently. Several candidates answered in the converse, which was fine on this occasion.

(g) Suggest why nicotine from e-cigarettes may be less addictive than nicotine from burned tobacco products (paragraph 45).

(3)

- In e-cigarettes there is no MAO inhibitors which are present in cigarette smoke.
- They normally lead to nicotine cravings by increasing reward behaviour.
- Lack of these in e-cigarettes lead to a decrease in addiction.

ResultsPlus
Examiner Comments

This candidate was awarded Mark point 1 for no MAOs, but then incorrectly stated that reward behaviour is increased not decreased, so no Mark point 3 could be given.

(g) Suggest why nicotine from e-cigarettes may be less addictive than nicotine from burned tobacco products (paragraph 45).

(3)

No MAO inhibitors present, so nicotine doesn't synergize with them. MAO ~~breaks~~ do are enzymes that oxidise/ break down neurotransmitters at the synapse. Due to ~~the~~ of their ~~in~~ inhibitors absence in e-cigarettes, neurotransmitters are broken down normally and ~~preventing~~ prevented from carrying impulse across a synapse. thus reward behavior is limited. (Neurotransmitters bind to receptors on post synaptic knot)

ResultsPlus
Examiner Comments
This was a well structured answer and gained 2 marks.

(g) Suggest why nicotine from e-cigarettes may be less addictive than nicotine from burned tobacco products (paragraph 45).

(3)

Because nicotine from e-cigarettes does not occupy the nicotinic receptors to the same extent as nicotine from tobacco smoke so ~~less~~ more neurotransmitter can be reabsorbed at the synaptic cleft causing a lower effect of nicotine. ~~and~~

ResultsPlus
Examiner Comments
This candidate uses their own knowlegde incorrectly, rather than that provided.

Question 7 (h)

This question focussed on how nicotine stimulates neurotransmitters involved in Parkinsons disease and asked how this helped to reduce symptoms. Some candidates correctly named the neurotransmitter as dopamine, but others then went on to talk about its role in binding to receptors, stimulating an action potential and alleviating muscle stiffness, for example.

(h) The article states that nicotine may have an ameliorating effect on Parkinson's disease (paragraph 43).

It is thought that nicotine stimulates the release of the neurotransmitter involved with Parkinson's disease.

Suggest how this might reduce the symptoms of Parkinson's disease.

(3)

It reduces the symptoms of Parkinsons disease because it does not let ~~act~~ action potential take place and synapses don't usually get transferred from presynaptic membrane to post synaptic membrane. This action is trigered in the brain which therefore reduces the symptoms of Parkinson's disease.

ResultsPlus
Examiner Comments

This response only scored 1 mark.

(h) The article states that nicotine may have an ameliorating effect on Parkinson's disease (paragraph 43).

It is thought that nicotine stimulates the release of the neurotransmitter involved with Parkinson's disease.

Suggest how this might reduce the symptoms of Parkinson's disease.

(3)

~~Nicotine~~ Increases the level of dopamine in synaptic cleft. ~~to~~ Dopamine binds to receptors on post-synaptic membrane, causing depolarisation of neuron. As Parkinson's is caused by a reduction of dopamine in synapses, this ameliorates the symptoms as post-synaptic neurone is stimulated.

ResultsPlus

Examiner Comments

This candidate scored full marks for linking cause to effect in a logical sequence.

Question 7 (i)

Candidates were asked to comment on why smoking tobacco reduces the FEV1/FVC ratio. The question was well answered and interpreted with the majority scoring 2 marks.

(ii) The FEV1 / FVC ratio is expressed as a percentage.

The normal ratio is 70 to 80%.

The FVC value is less likely to change in people who smoke.

Using the information in paragraph 50, suggest why the FEV1 / FVC ratio is significantly reduced after smoking tobacco.

(2)

i) FEV1/FVC in smokers is 62.8% - 72.8%. This because, tar damages cilia, so mucus accumulates as it cannot be moved. This narrows the airways. In addition there is loss of elasticity, so there is less recoil. Therefore FEV1 is lowered as there is less exhalation. Nicotine also causes bronchoconstriction, so also airway obstruction increases even more

ResultsPlus

Examiner Comments

This candidate scored full marks for a good answer including loss of elasticity/narrowed airways/ less exhalation.

(ii) The FEV1 / FVC ratio is expressed as a percentage.

The normal ratio is 70 to 80%.

The FVC value is less likely to change in people who smoke.

Using the information in paragraph 50, suggest why the FEV1 / FVC ratio is significantly reduced after smoking tobacco.

(2)

Smoking tobacco may cause the lungs to shrivel which causes the volume of air breathed into the lungs to be less thus decreasing the FEV1 / FVC ratio.

ResultsPlus

Examiner Comments

This candidate incorrectly refers to inhalation rather than exhalation so no marks were awarded.

Question 7 (j)

Candidates were asked to sketch a graph and label the axes to show the relationship between cytotoxicity and the concentration of E-cigarette liquid for one mark. It was well answered although some candidates incorrectly drew bar graphs or labelled axes the wrong way around. Most candidates drew a line showing a positive correlation for 1 mark.

Candidates were able to demonstrate their knowledge and understanding by tackling the wide range of questions offered by this paper. It was clear that a high number of candidates had studied the pre-release article as they were able to relate their reading of the questions asked in a meaningful way in their answers. Lack of blank spaces indicated that most found the questions accessible.

Candidates continue to attempt to “set the scene” at the start of an answer, simply repeating the stem of the question and wasting time by writing information already provided and gaining no credit.

There was some misinterpretation of some questions but this was minimal on the whole, and candidates applied knowledge to unfamiliar scenarios that were presented. The level of knowledge demonstrated overall was satisfying.

Paper Summary

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

- Look closely at the number of marks allocated to each question and equate this to the number of ideas or points presented.
- Use precise, scientific terminology of an A level standard.
- Read the stem of the question closely before committing an answer to paper.
- Understand that simply repeating the stem is unlikely to gain any credit.
- Show workings in calculation questions to avoid losing marks.
- Understand that the command word 'explain' requires a biological rationale in the answer and not simply a description.
- Show how data has been manipulated where required instead of simply quoting figures from a graph or table.
- Use time management sensibly.
- Have a greater appreciation of the scientific method, in particular the design of experiments.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL.