General comments

The majority of candidates provided good responses of appropriate length, indicating they used the space provided after each question as a guide for the depth of response required. This limited wasted time. In previous years candidates have written lengthy responses to simple questions. It is pleasing that tutors are preparing candidates effectively in this aspect of assessment. Most candidates responded to most questions, showing that they understood what each question was asking, or were at least prepared to address the topic as best they could. By grouping topic questions together, candidates were able to concentrate their efforts. However, limited literacy skills appeared to affect the ability of some candidates to demonstrate their knowledge of the subject. Poor spelling and grammar were evident in some responses; legibility was also a problem.

Understanding biology (UB)

The UB questions required candidates to provide evidence of their understanding of the basic principals of biology. Not including multiple-choice questions as in previous years required candidates to show that they not only understood the question but also had a deeper level of comprehension of the biological concepts being covered. While the range of responses provided was pleasing, the overall achievement of this criterion was poor. The need for candidates to gain a more thorough grounding in basic biological principles and concepts was evident. Some candidates appeared to respond incorrectly to what they thought the question required because they had not fully read the question.

Investigating biology

Being able to interpret data and to design investigations is a basic component of this examination. Many candidates’ responses reflected their involvement in designing experiments and investigations during their study of biology. Articulating all the elements of good experimental design to effectively test a hypothesis ranged from exceptional to questionable with only just over a quarter of candidates demonstrating a sound level of ability in this criterion. The number of
candidates who did not respond to questions involving experimental design was disappointing given the probable exposure to experiments during the year. A sound understanding of biology is based on the ability to understand the natural world, and this occurs ideally through questioning the phenomenon of the natural world using investigations and experiments. It is therefore crucial that candidates not only satisfy the requirements in the syllabus to undertake and understand biology experiments but are exposed to this manner of learning as an integral component of their study. Teachers should reflect on the pedagogy used to deliver biology and how it may be adjusted to reflect investigative methods being used to teach candidates about the theories of biology.

Evaluating biological issues

There was again an improvement in students focusing on the biology behind the issues being raised rather than simply the social or emotional impacts of the topic. However, the depth of response required to demonstrate responses of a VHA standard were limited. The majority of responses were short, and while they showed a basic understanding of the topic, the responses didn’t explain the biology that was being impacted on behind the issue. Candidates who planned their responses before choosing which question they would respond to in each topic appeared to show a much better understanding and articulation of the biological issue. There were limited omits with most candidates attempting one of the options given. The introduction of choice has been successful, however the overall treatment of the individual questions requires a greater depth and more planning.

Sample solutions

Sample solutions/responses for 2010 are printed on the following pages to help teachers and candidates prepare for future Biology examinations.
Part A – Cell structure and function

Section 1: Short response

Section 1 has 10 questions that assess Understanding biology and Investigating biology. Attempt all questions. Respond to the questions in the spaces provided.

Question 1

Using scientific conventions, draw and label a diagram of a plant cell showing three structures that are used to classify it as a plant rather than any other cell type.

Question 2

a. Below is a section of the plasma membrane of an animal cell. Label any three components on the diagram.

b. Link the structure of the membrane to its function.

The membrane's major function is the selective uptake of materials into (or out of) the cell. Protein molecules in the bilayer layer may have recognition molecules, forming binding sites for specific substances. These only then move into the cell via the channels between protein molecules.

(or cell boundary)
Question 3

Explain how the role of the Golgi apparatus and the rough endoplasmic reticulum are related.

The rough endoplasmic reticulum is the site for protein synthesis. The Golgi apparatus then modifies these proteins as necessary.

Question 4

Define translocation in plants.

The transport of any biochemical in phloem (e.g., sugar) is called translocation.

Question 5

Draw a labelled diagram to show the process of mitosis in an animal cell with two chromosomes.
Question 6

Explain, using examples, the difference between osmosis and diffusion.

Hint: a diagram may be useful.

...Osmosis is the diffusion of water particles across a membrane...

Diffusion is the movement of a particle from a place of high concentration of that particle, to a place of lower concentration of that particle.

![Diagram showing osmosis and diffusion]

Question 7

Choose a substance that moves across cell membranes by active transport. Explain the process involved.

...K⁺ in root cells move into the cell by active transport... Because they move against a concentration gradient, i.e., from a place low in K⁺ to a place of high K⁺, energy (ATP) is expended by the cell to allow the process to occur. It is active, not passive (diffusion).

Question 8

Explain why the statement below is false.

“Light-independent reactions occur in mitochondria whether light is present or not.”

...The light-dependent stage of photosynthesis (in plants) releases the oxygen needed by the mitochondria to perform respiration, which is itself not light dependent.
Question 9

The aim of an experiment is to demonstrate the benefits of plant cells having a cell wall when investigating the process of osmosis.

a. Formulate and justify a hypothesis.
b. Design an experiment to test the hypothesis.
c. Evaluate how the method will test the hypothesis.

c) Hypothesis. (Potato) cells will take up water, only if they have a functional cell wall.

b) Procedure. 1. Cut 2. pieces, potatoes, of equal size into 1 cm cubes, and place on separate beakers, containing 200 ml of distilled water.

2. Treat one beaker of potato to destroy the integrity of the cell membrane. Boil 10 mins, allow to cool.

place each in 200 ml of distilled water.

3. Allow each of the two beakers to sit in distilled water for 24 hrs.

4. Measure the area of each potato cube to average the result of each treatment.

<table>
<thead>
<tr>
<th>Cube Treatment</th>
<th>Beaker 1 (Control)</th>
<th>Beaker 2 (Treated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cube 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cube 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average, area, size (mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1

Discussion. If the hypothesis is correct, the untreated cubes will swell with water because their average size, because of osmosis, while the treated cubes will not.

The experimental design assumes that the treatment affects the cell wall only. Whereas, boiling affects the cell membrane and cell membrane control water uptake into cells.

* Correct cell wall removal treatment would be acid hydrolysis as everyone...
Question 10

Many types of fruits and vegetables go brown when cut due to an enzyme that produces a brown-coloured antiseptic, which protects the cut section of the fruit from disease. In an experiment to investigate the action of this enzyme, puréed potatoes were filtered to extract the enzymes. The filtrate was then kept in an ice bath. The filtrate was poured into test tubes and then placed in an incubator at 37°C for 10 minutes.

a. Complete the table with your prediction of what would be seen in each test tube.

<table>
<thead>
<tr>
<th>Test tube</th>
<th>Substrate (mL)</th>
<th>Enzyme extract (mL)</th>
<th>Distilled water (mL)</th>
<th>Predicted observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>solution does not go brown</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>substrate does not go brown</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>solution goes brown</td>
</tr>
</tbody>
</table>

b. Explain the predicted results.

For the enzyme to convert the substrate into brown solution, product, they must both be present. This only occurs in test tube 3.

End of Section 1
Q1 Plant tissue culture

- Tissue culture, clones, cuttings, bulblets, 'eyes' all are examples of asexual reproduction. This means that the one parent cell produces genetically identical daughter cells.

- Variation within a species is being selected against as the gene frequency of specific traits increases when these techniques are used.

- 'Good' traits may be useful for high yield crops, but variation within a species ensures its long term survival, and thus the long term impact of genetic closing may end in occurrences such as the Great Irish Potato famine in which the asexually reproduced potatoes were all wiped out by a disease.

- If one asexually reproduced organism has a 'flaw', they all will.

- Over long term frames, needs change, environments change, a sexually reproducing population would guard against extinction by having offspring with a variety of adaptations able to therefore survive and perpetuate in a wider variety of conditions.
Successful medical treatment with medicines often saves lives, without which many sick individuals would die, and if they die young enough, the gene would be removed from the human gene pool, thus lowering the genetic frequency of this trait when the disease has a genetic basis.

- Treated individuals however, are not able to reproduce. Any genetic trait that made them responsive to a particular disease, would be maintained in the gene pool when they reproduced. This increases the % people in future generations in the same situation as they are re susceptible to a disease needing drugs for treatment of it.

- In the long term this means people will continue to rely on the need for such drugs.

- Some humans may be naturally resistant to a disease and may recover easily without medication. If only these people 'survived', the human population would in the long term be selected to not need the particular drug, and people who did catch a disease would have the adaptation of being able to repair itself.
Part B – Physiology of organisms

Section 1: Short response

Section 1 has seven questions that assess Understanding biology and Investigating biology. Attempt all questions.
Respond to the questions in the spaces provided.

Question 1

Compare and contrast the concentration of substances in the renal arteries with those in renal veins.

<table>
<thead>
<tr>
<th>Substances</th>
<th>Renal Artery</th>
<th>Renal Vein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>rel. higher</td>
<td>rel. lower</td>
</tr>
<tr>
<td>Sodium</td>
<td>rel. higher</td>
<td>rel. lower</td>
</tr>
<tr>
<td>Glucose</td>
<td>same conc. as renal vein</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>same conc. as renal vein</td>
<td></td>
</tr>
</tbody>
</table>

Question 2

Draw a diagram to explain the process of transpiration in a plant.

[Diagram of plant leaf with labeled parts: cuticle, epidermis (upper), spongy mesophyll, mesophyll layer, stomata, lower epidermis, guard cells, movement of water particle, H2O particle, chloroplasts.]

2010 Senior External Examination  Assessment report — Biology
Question 3

Air conditioners used in most homes and businesses across Australia are thermo-regulated. The human body is thermo-regulated for the homeostasis of temperature.

a. Predict the possible effect on the sensory systems that deliver information to the human brain if a person were to stay in air-conditioned rooms for their entire life.

b. Contrast this with people who need to move in and out of buildings that are air-conditioned constantly all day, such as a delivery truck driver.

Question 4

The control of temperature and the control of carbon dioxide concentration in blood and tissues take place by a similar mechanism. Briefly explain one difference between the two control systems.

Question 5

In the human body, the rate of diffusion of a substance across a membrane can be sped up. State two factors that would contribute in this way, and explain why.

1. A large concentration gradient will speed up diffusion.
2. A large surface area can speed diffusion by allowing more particles to transfer across a membrane over a certain time frame.

(Also, another surface?)
Question 6

a. An experiment was designed to investigate how transpiration rates vary with different environmental conditions. Identify the dependent and independent variables.

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>water vapour produced</td>
<td>wind speed (0, 5, 10, 15, 20 km/h)</td>
</tr>
</tbody>
</table>

b. State the control.

0 wind speed

Question 7

This table shows the percentages of gases in inhaled and exhaled air in humans.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Inhaled air (% volume)</th>
<th>Exhaled air (% volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>20.95</td>
<td>16.40</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.04</td>
<td>4.10</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>79.01</td>
<td>79.50</td>
</tr>
<tr>
<td>Water</td>
<td>humidity dependent</td>
<td>saturated</td>
</tr>
</tbody>
</table>

Compare the quantities of gases in the inhaled and exhaled air. Interpret the data based on your understanding of respiration to determine any links that appear to exist between gases. Suggest a reason for this.

Q. Respiration in cells converts oxygen and carbon dioxide into carbon dioxide and water, which are then removed via the lungs and the environment by diffusion from the blood stream.
Paper 1:

Part B.
Points which may be included:

a. Lifestyle diseases of lung cancer.

- Lung cancer has become more prevalent in the last 50 years, particularly in women. A major contributor to this disease is airborne particulate matter which is breathed into the lungs. Smoking and pollution are major contributors to these airborne particles. Women in particular have increased the % of smokers in the last decade, especially as young women join the ranks of a previously male dominated social habit (1950).

- For this to change in the next 50 years, the environmental cause of smog needs to be minimized. Pollution lenses may limit industrial production of toxic gases and thus lower lung diseases such as lung cancer.

- It is personal behaviour that is more critical a factor. If people stop smoking they dramatically lower their chance of getting lung cancer.

- As fewer people die from infectious diseases, because of effective medical intervention, more people live to age when lifestyle disease may shorten their life e.g. cancer has increased in our society.
Paper 1
Part B

some points which may be included.

a) Disease management

- Continents in today’s world are interconnected easily and frequently. With modern air travel, we are no longer isolated communities. Disease organisms can spread quickly and easily.

- When a serious threat is identified, communication between medical authorities and governments across the world can help forestall effects of dangerous diseases and prevent pandemics. The World Health Organization could play this role.

- Australia already has an excellent and vigilant customs service which places limitations on goods which we can bring into the country and quarantine others. In this way potential disease carriers are blocked, indigenous species are protected. Humans are no different. We too are a species vulnerable to disease.

- One role of the WHO should be, that of being informed immediately of any serious disease outcome. That way it can pass on information quickly.

- The WHO must also reliably assess risk. Being overly reactive only lessens credibility, whereas dangerous situations arise, warnings may be ignored. The WHO needs to remain credible and creditable, to reliably prevent pandemics.
Part C – Organisms and ecosystems

Section 1: Short response

Section 1 has eight questions that assess Understanding biology and Investigating biology. Attempt all questions.
Respond to the questions in the spaces provided.

Question 1

Coral polyps often contain algae living within their tissues, which contribute to their spectacular colours. The algae generally do not survive outside the polyp and the coral grows more slowly if the alga are not present. State the name of this biological association.

mutualism

Question 2

Explain the difference between primary and secondary succession using specific examples.

Primary succession is the sequence of communities which established one after the other after an event such as an exception of a volcano, e.g., Volcano Osorno in South Chile.

Secondary succession may occur in an area in which there has already been a community, e.g., Victoria's Gold Wednesday mine removed the dominant plant species, which was left alone and communities of grasses can slowly the trees established themselves.

Question 3

Choose an organism. Explain how it is behaviourally, structurally or physiologically adapted to its natural environment.

pig Brown Snake

Behavioural: swimming from disturbance, protects itself from predators

Structural: the long, narrow shape of the snake allows it to move between plants, roots, etc.

Physiological: the chemical production of its poison glands allows it to kill prey.
Question 4

Explain how eutrophication affects the organisms in a river system.

Eutrophication causes proliferation of algae, photosynthetic bacteria. When these organisms use up available nutrients, they die, settle to the bottom, decompose. Decomposers increase, using up oxygen and causing other aquatic organisms to elute. Some consumers, like fish, become extinct. Bacteria and decomposers may thrive however.

Question 5

Draw a labelled diagram of the carbon cycle that includes the following terms:

- respiration
- atmospheric carbon dioxide
- burning fossil fuel
- biomass.
Question 6

During a field investigation at a woodland ecosystem, a student noticed that slaters (a terrestrial crustacean easily recognised by their armoured, flattened bodies which are often a greyish pink colour) appeared to be most abundant in moist dark conditions where humus was plentiful. Formulate a hypothesis that explains the distribution of slaters.

Slaters are sensitive to light and if exposed to sunlight, they will scurry into dark areas. One such dark area is under the protective layer of humus over the soil. This is why they are found mainly in this environment.

Question 7

The table below shows figures relating to the recycling of plant biomass in two different ecosystems.

<table>
<thead>
<tr>
<th></th>
<th>Living plant biomass (kg/m²)</th>
<th>New plant material per year (kg/m²)</th>
<th>Organic matter in soil (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deciduous woodland</td>
<td>40.7</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Tropical rainforest</td>
<td>52.5</td>
<td>3.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Use the data to demonstrate why the deforestation of rainforests has more of a long-term impact than the deforestation of deciduous woodlands.

Tropical rainforests contain 20% more biomass, and produce 400% more new plant material each year, than deciduous woodland. Thus, they are particularly important in lowering atmospheric CO₂ and provided O₂ required by living organisms.
Question 8

Draw a completed quadrat of a hypothetical 10 m x 10 m study area. Include a key for the species of plants that may have been found there, and are included in your field sketch. Place a transect line through the centre of the sketched quadrat. From this, create a diagram of the representative transect profile.

Briefly discuss how this data could be used when examining ecosystems.

Quadrants depict the distribution of organisms, as well as their relative number, while transects inform of the size of organisms. This gives knowledge of ecosystem biodiversity and organization.
Paper 1

Part C

Points which may be discussed

Q 1. Biodiversity

a) Human activity reduces biodiversity by clearing vegetation/industry

b) Human activity increases biodiversity by preserving endangered species via zoos, genetic engineering etc.

c) Nature creates biodiversity as evolutionary response to altered conditions; a new niche opening.

d) Nature eliminates biodiversity when natural selection removes certain organisms which are not well adapted.

When the number of species in biodiversity decreases, fewer organisms are available to occupy environmental niches, making the entire community more vulnerable, as producers, consumers, predators & prey, all interrelate in a fragile balance, each affecting the other.

Biodiversity could be reduced by: legal/regulations against a) above: controlling biodiversity loss, i.e. keeping a healthy variety of organisms in balance with natural ecosystems.

Similarly b) above would increase biodiversity, but not the diversity nature alone would promote, rather one crafted by man, without the natural checks & balances of natural predators & control built into living communities.
Mangroves and swamps provide ecosystems with a rich biodiversity. They provide habitats for organisms which are needed in healthy aquatic ecosystems. Producers, consumers, predators and prey exist in these natural ecosystems in a fragile balance, with one organism affecting all of the others.

Protecting these environments would minimise the disturbance to food chains and food webs in the surrounding environment.

The disadvantage of this protection is that humans would then need to disturb other ecosystems to fence new land for housing. This would also have an impact on their interactions with their surroundings.

Another disadvantage to humans is that mosquito populations which breed in mangroves would thrive if they live in protected habitats, and these insects may be disease carriers.
Part A – Continuity of life

Section 1: Short response

Section 1 has eight questions that assess Understanding biology and Investigating biology. Attempt all questions. Respond to the questions in the spaces provided.

Question 1

Briefly explain the major difference between meiosis and mitosis.

Meiosis results in gametes with half the chromosome (n) number. One of each homologous pair is part of the sexual reproduction process. While meiosis occurs asexually, when chromosomes are replicated to produce a daughter cell genetically identical with the parent cell (2n).

Question 2

In guinea pigs, short hair (S) is dominant over long hair (s). Two short-haired guinea pigs were mated and they produced equal numbers of short-haired and long-haired offspring. Show your working to establish the genotypes of the parents.

Question 3

The Wollom Pine is one of the world’s rarest plants. The natural population of about 38 plants has very little genetic diversity. Explain why this lack of genetic diversity may affect the ongoing survival of this species.
Question 4

Draw a graph that shows the changes in thickness of the uterine wall throughout a complete menstrual cycle.

On the graph, explain the effects of one hormone in one stage.

Question 5

Choose an organism that produces many offspring (e.g., a fish) and one that produces only one or two at a time (e.g., a horse). Compare and contrast the reproductive strategies of these organisms in relation to the success of the species.

Fish... ensure their survival by producing large numbers of offspring... most of which will not survive... the challenges... environment, physical factors, predators, food... simply, they are not... protected by parents as young... as in horses... here each offspring has a high chance of surviving till maturity... because of the maturing parental behavior... Both strategies, however, end with the result of a new generation surviving to produce another.
Question 6

Use a pedigree (including an appropriate key that follows biological conventions) to demonstrate the inheritance of a sex-linked recessive gene on a family.

![Pedigree for haemophilia](image)

**Key**
- $X^H$ X chromosome carrying normal allele for blood clotting
- $X^h$ X chromosome carrying allele for haemophilia
- $Y$ Y chromosome not carry either allele. (sex linked trait)

Question 7

Snapdragons (a common decorative flowering garden plant), the homozygous conditions are red and white flowers while the heterozygous condition is pink flowers. This is an example of incomplete dominance. Use a Punnett square to show the working used to establish the genotypes and phenotypes of a cross between a white flower and a pink flower.

![Punnett square](image)

**Phenotypic ratio** 50% pink : 50% white

**Genotypic ratio** 50% hybrid ($Rr$) : 25% homozygous.
Question 8

The following diagram shows a pedigree for the condition of albinism in humans. People with albinism lack pigment in the hair, skin and eyes.

State the type of inherited trait that albinism demonstrates. Use information provided in the diagram in your response.

Albinism is a recessive trait. It appears in offspring where parents do not have the trait. It is present, but hidden, in X. Who are carriers, in heterozygous. Whilst the trait is only seen here on females, there is insufficient information to conclude for sure if the trait is sex limited. More individuals are needed, when no males ever display the albinism trait, for this to be classified as a sex linked trait.

End of Section 1
Paper 2.

Points which may be discussed

Q1 Transgenic organisms:
  There may be positive negative effects of the use in modern society of
  transgenic organisms
  - Transgenic organisms contain combinations of genes or
    characteristics which do not occur naturally.
  - As such they may not have natural
    predators of the outstanding competitor and thus
    upset the balance of nature.
  - Their deliberate effect on humans has some
    advantage or they would not have been introduced
    presumably eg higher crop yields.
  - There may be other effects on humans which
    are yet unknown which are harmful
    eg new bacteria without effective antibiotics that
    cause disease.

Q2 Reproductive Technologies
  - Selection criteria of applicants of reproductive technologies is
    advised if the human genome is not to been altered in a
    deleterious fashion for the human species.

  If people with genetic disorders are allowed to use their own
  genes to artificially produce offspring, this acts against
  the principle of natural selection, which would
  ensure the survival of a "fitter species" by removing
  harmful genes from the gene pool.

  If such individuals were allowed to access
  reproductive technologies where other peoples sperm
or egg was used; or if their sperm or egg was 'altered' to eliminate 'defective' genes, then the broader human gene pool would not then carry this deleterious trait.

- Moral principles complicate which genetic disorders are "unsuitable": who decides? Why? What is good? Bad?

- Altering genes in any individual by man is replacing nature as the selection agent. Do we know better? Evolution has naturally selected characteristics of species over eons. Is it arrogance of humans over nature that is really the wise?
Part B – Evolution and diversity

Section 1: Short response

Section 1 has four questions that assess Understanding biology and Investigating biology. Attempt all questions.
Respond to the questions in the spaces provided.

Question 1
When using the binomial naming system of classification, the first word represents which level of taxonomy?

Question 2
Stinging nettles, blue-bottle jelly fish and wasps are all capable of producing painful stings. From which type of evolution is this characteristic most likely to have evolved?

Question 3
Male kangaroos establish territories containing a number of female kangaroos with whom they mate. They must fight other males to maintain these territories. Male kangaroos are much larger than females and are specifically adapted to establish and defend their territories. In terms of natural selection, explain one advantage and one disadvantage of this type of competition between males.

The advantage is that the strongest males are the ones which will mate and pass their genes onto the next generation.

A disadvantage is that characteristics of the 'weaker' males will be lost from the gene pool, resulting in less variation; they may contain other favourable genes.
Question 4

Briefly explain Darwin’s theory of natural selection, using an appropriate example.

...The better adapted organisms tend to survive and reproduce, passing their characteristics (genes) on to the next generation.

E.g., the peppered moth changed from a mostly light form in early 19th century... to...a... formed... late... 1800... This was connected with the increased... and... than... no... industrial revolution... the... common... of... marks...

Darwin said that certain changes occur over... more like themselves...

Question 5

Construct a dichotomous key that will correctly classify the following organisms: mammal, bird, reptile, fish, insect.

[Diagram of dichotomous key]
Question 6

The table below shows comparisons between the amino acid sequences in the DNA of echidnas, platypus and kangaroos.

<table>
<thead>
<tr>
<th>Pairs of organisms</th>
<th>Number of amino acid differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platypus – grey kangaroo</td>
<td>35</td>
</tr>
<tr>
<td>Platypus – echidna</td>
<td>10</td>
</tr>
<tr>
<td>Platypus – potoroo</td>
<td>32</td>
</tr>
<tr>
<td>Echidna – potoroo</td>
<td>29</td>
</tr>
<tr>
<td>Echidna – grey kangaroo</td>
<td>34</td>
</tr>
<tr>
<td>Potoroo – grey kangaroo</td>
<td>11</td>
</tr>
</tbody>
</table>

Use a diagram to show the evolutionary relationship between the organisms in the table. Explain your reasoning with specific reference to the data.
Paper 2

Part B.

Key points which might be raised:

Q1 Medical Technology

* Medical technology may impact human evolution to our detriment. This may affect natural selection by man.

* Nature is being replaced as the selection agent as to who survives and passes genes on to the next generation.

* Humans with a genetic weakness may receive medical assistance allowing them to survive and thus contribute to the human gene pool. This propensity to cancer, or heart disease may be higher as in human populations as such individuals are treated medically.

* Humans past child bearing age, or who are sterile could receive such medical assistance without affecting the gene pool.

* Evolutionary pathways diverge when different environments cause different selection pressures favouring on genetic combination over another. Raising man over nature in control of this selection leads to different outcomes to those which nature would provide.
Points which may be discussed

Part B

**Q2 Pesticide + Antibiotic resistance**

Chemical resistance occurs when repeated exposure to a chemical selects organisms to survive and reproduce which are naturally resistant to the chemical. Populations increase the gene frequency of these adaptations.

- Ongoing use creates resilient pest populations which are therefore difficult to kill, necessitating the use of different drugs or insecticides which are able to kill these organisms. Populations will likely develop resistance to new drugs too, so this is an ongoing need, to find new drugs to treat newly resistant strains.

- The last 100 years has seen a scientific revolution occur where man has been able to create a wide range of powerful chemicals or pesticides resistant to disease, answering a need of man to preserve human life as far as possible, by treating infected people, or agricultural crops which provide our food.

- These resistant effects have been observed only after the widespread use of chemicals to stop resistance. It may be that alternatives, such as natural predators, may biologically control pests in many cases without the need to use pesticides.