Unit 3 Biology
Revision Booklet 8 – Solutions

2012 – Question 5

Question 5a.

Marks	0	1	2	Average
%	25	6	69	**1.5**

As it was ambiguous whether the polypeptide referred to on the *y*-axis of the graph was for the substrate of the reaction or the product of the reaction, there were two ways to answer this part of this question:

- polypeptide is the substrate. At 10 °C the mark should be higher than the 37 °C mark, and the 80 °C mark would be even higher than the 37 °C
- polypeptide is the product. At 10 °C the mark should be lower than the 37 °C mark, and the 80 °C mark would be even lower than the 37 °C.

Students could indicate their value either as a bar/line/cross on the graph or draw a continuous line; for example, a bell-type graph.

Question 5b.

Marks	0	1	2	Average
%	33	21	46	**1.1**

- 10 °C: The reaction occurs at a slower rate as it is lower than the optimum temperature or there are fewer collisions occurring between the enzyme and substrate molecules.
- 80 °C: The enzyme is denatured.

2010 – Question 2

Question 2a.

Marks	0	1	2	Average
%	29	44	27	**1**

Cell membrane: To regulate the inputs/outputs of the cell
Porin: To allow large/water soluble/polar molecules to enter/leave the cell, or site of facilitated diffusion or active transport

The question asked for a function of each structure; therefore, 'The porin is a protein channel' was incorrect. Some students gave functions of each structure which, though correct for a multicellular eukaryotic cell, were not correct for a bacterium; for example, 'Porin, cell to cell communication'.

Question 2b.

Marks	0	1	2	3	Average
%	25	32	31	12	**1.3**

The following is an example of a possible answer.
Hypothesis: Mice fed hard pellets will weigh more than mice that are fed soft pellets
Experimental procedure: Two groups of mice: one group fed hard pellets and the other soft, and all other variables controlled
Results: Mice fed hard pellets weighed more than mice fed soft pellets

Too many students wrote their hypothesis referring to energy expenditure. It was apparent that some students do not understand the difference between an aim and a hypothesis and would benefit from more practice writing hypotheses in class or for school-assessed coursework.

Students did not need to state the features of the mice as these were given in the stem of the question; however, they needed to identify a factor which should have been controlled, for example, water availability.

The results needed to relate directly to the hypothesis. Measuring weight was by far the most feasible method; however, measuring the activity of each group was also considered a suitable measure in this case.

Overall it was most pleasing to see the quality of answers to this question. Most students were able to gain some marks and show their understanding of scientific method. It was evident that some students did not read the stem of the question carefully.

2009 – Question 4

Question 4ai-ii.

Marks	0	1	2	3	4	Average
%	17	13	24	29	16	**2.2**

Question 4ai.
Following is an example of a suitable set up.

- Take two groups of tomato plants that are the same age type and state of health. One group is affected with beet caterpillars, the other is unaffected.
- Both groups are kept in the same environment (for example, the same temperature and water availability).
- Wasps are released and their activity is observed.
- Large numbers of plants are used or the experiment is repeated many times.

To answer this type of question effectively students should:

- plan their answer before they begin writing
- use only the hypothesis given in the question stem
- use only the information given in the question.

Question 4aii.
If more wasps visited the plants eaten by caterpillars than the unaffected group then the hypothesis would be supported.

This question was well answered as most students made a **comparative** statement.

Question 4b.

Marks	0	1	Average
%	49	51	**0.5**

The jasmonic acid would attract the wasps, which kill/eat the beet caterpillars.

Students with a sound understanding of scientific method were able to readily apply this knowledge to different situations presented.

Incorrect responses included the wasps scaring the caterpillar or the wasps pollinating the plant. The term 'insect' could have referred to either beet caterpillars or wasps so responses that used this term could not be awarded a mark.

Many students gave multiple reasons when only one reason was required. Students would benefit from giving their best answer first.

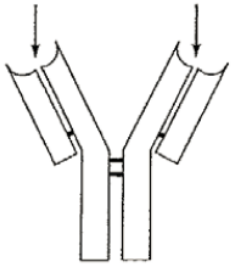
2008 – Question 6

Question 6

This question provided the opportunity for students to apply their scientific knowledge, but with varying success.

Question 6a.

Marks	0	1	2	Average
%	28	22	50	**1.3**



Question 6b.

Marks	0	1	Average
%	40	60	**0.6**

An autoimmune disease is one in which the body identifies some self cells as non-self and attacks them.

This question was reasonably well answered; however, a common incorrect answer was that an autoimmune disease is a disease of the immune system, such as AIDS.

Question 6c.

Marks	0	1	Average
%	79	21	**0.2**

A hormone is a chemical compound produced in a cell. It either acts within the cell or diffuses or is transported to other cells where it brings about a specific response.

This part was not well answered. Students needed to expand at least in part on the definition provided, taking into account other examples of hormones they had studied. Too often, the new definition was even shorter than that given or was made more specific and hence more incorrect; for example, 'produced by endocrine glands'.

Question 6d.

Marks	0	1	2	3	4	5	Average
%	12	12	19	26	19	12	**2.7**

Hypothesis

- That treatment with Vitamin D reduces the chance of mice developing rheumatoid arthritis

Experimental Design

- Use two large groups (for example, 20) of similar mice which normally develop rheumatoid arthritis.
- Treat the experimental group with Vitamin D. The other group, the Control group, are given a placebo and do not receive Vitamin D.
- Keep all other factors constant, such as diet, space, water and temperature.

Results

- For the hypothesis to be supported, fewer mice that are given Vitamin D should develop rheumatoid arthritis than those in the Control group.

The improvement in answers to this question compared to similar questions in the past was pleasing. Students who scored full marks gave a well set out and reasoned response that clearly answered each part of the question and were a pleasure to read.

Experimental design is integral to science and this question exposed many deficiencies in students' knowledge and understanding of the process, in particular the writing of a hypothesis. Too often, students gave an 'aim' rather than a clear hypothesis statement which could be tested. Students would benefit from more practical experience with appropriate examples.

2006 – Question 3

Question 3a.

Marks	0	1	Average
%	43	57	**0.6**

A drug that has been man made to prevent the action of a particular infective agent and hence prevents the development of the particular disease.

Vaccines and antibodies are not designed drugs and were inappropriate answers.

Question 3b.

Marks	0	1	2	3	Average
%	40	19	21	20	**1.2**

Some students failed to understand that a designed drug needs only to prevent initial entry of the virus **or** prevent exit from an initially infected cell to be effective, hence making the task longer than necessary. A common error was an attempt to coat every cell of the body with the drug rather than inhibit the entry of virus particles or prevent their spread once entered.

Although many students' diagrams were excellent, others failed to act as a supporting means of communication about the process being verbally described. Some diagrams were completely irrelevant.

Question 3c.

Marks	0	1	2	3	Average
%	38	32	23	6	**1.0**

Points for consideration in the experiment that students were asked to design included:

- the selection of the mice. These should have been two large groups of identical mice kept in the same environmental conditions
- the number of mice in each group. It was preferable for students to state a specific number (of reasonable magnitude) in each group, instead of simply describing a 'large' group. If no mention was made of the size of the group, then the idea of replication of the experiment needed to be mentioned
- the infection of both groups with the virus against which the drug has been designed. One of the groups then needed to receive no further treatment (the control group), the other group (the trial group) receives the drug under investigation
- after a few days, each of the groups needs to be examined and the number of mice that have developed the viral disease in each group counted. If the number of mice in the trial group is significantly less than the number in the control group, the drug has been effective.

Common errors in the experiments described included selecting only two mice without referring to repetition of the experiment; not mentioning the similarity of the mice and/or environment; injecting mice with the virus and then waiting days or weeks before the drug was used; administering the drug first and then exposing the mice to the virus days or weeks later; and general statements about comparing the results, without any reference to what result would indicate effectiveness of the drug.

Experimental design is integral to science and this question exposed many deficiencies in students' knowledge and understanding of the process. Students need more practical experience with appropriate examples.

2005 – Question 4

Question 4

4a

Marks	0	1	Average
%	77	23	**0.2**

Either of:

- the dry weight gives an indication of plant growth – biomass
- water content is variable (that is, each plant could have different amounts of water) and is not an indicator of growth.

The aim of the experiment was to determine the effect of a plant parasite on plant growth. Therefore, when the plants were measured the measurement had to reflect plant growth. That is why dry weight is used.

4b

4b

Marks	0	1	Average
%	31	69	**0.7**

Any of:

- nutrients
- glucose
- an energy source.

4c

Marks	0	1	Average
%	65	35	**0.4**

The parasites appear to reduce/slow down plant growth.

Some students incorrectly suggested that the plants lose weight due to the presence of the parasite. The parasite is slowing plant growth as it uses the nutrients that would normally be available for the plant. This is not the same as the plant losing weight. Some students indicated that the parasites affected plant growth but did not explain whether they increased or decreased growth. These students could not be awarded a mark. Students needed to keep in mind the aim of the experiment and then make a relevant conclusion.

2005 – Question 5

Question 5

5a

Marks	0	1	2	Average
%	47	33	19	**0.8**

Conclusion 1 and evidence

Either of:

- a four-week-old mouse that receives a graft of tissue of a kind it has never encountered before identifies it as a foreign body and makes antibodies against it **because** the mouse rejects the graft several weeks after receiving it
- by the time it is four weeks old, a mouse has a competent immune system that is able to respond to the presence of foreign materials **because** the mouse rejects the graft several weeks after receiving it.

Conclusion 2 and evidence

- The immune system of a newborn mouse accepts foreign material and remembers it as self **because** when, after four weeks, a graft is made of the same type tissue there is no rejection of the graft.

Generally students outlined the results of the experiment without making any conclusions and could not be awarded the marks. This question again highlights the need for students to be able to make valid conclusions when presented with the results of an experiment.

5b

Marks	0	1	Average
%	42	58	**0.6**

The mouse was not exposed to strain C leucocytes as a newborn, so it would be expected that the skin graft from strain C would be rejected **because** the mouse would identify it as a foreign body and make antibodies against the tissue.

Some students predicted what would happen with strain B as well as strain C. Students are reminded to read the question and only respond to the question asked. This will save them time and guard against the possibility of making an incorrect statement.

5c

Marks	0	1	Average
%	68	32	**0.3**

Apoptosis is natural cell death. In the formation of a tumour, apoptosis is occurring at a slower rate than the reproduction of new cells, hence a tumour forms.

Most students could define apoptosis but could not apply this knowledge to the question. Many students incorrectly thought that a tumour was a mass of dead cells.

5d

Marks	0	1	2	Average
%	57	34	9	**0.6**

An outline of an experiment would be:

- take two groups of genetically identical mice
- inject dead cells from the tumour growth into members of group A
- give no treatment to the mice in group B
- some weeks later, inject the mice in both groups with living cells from the tumour
- examine the mice several weeks later. If the hypothesis is correct, group A mice should remain healthy and group B mice should develop the tumour.

The question stem gave students clues about what could be used in the experiment. The stem stated that some cells from the tumour were killed while others were kept alive for several weeks for later use. Both pieces of information should have been used by the students when formulating their answers.

Many answers included the following errors:

- only using one mouse in the experiment
- having no control mice
- not using the dead cells from the tumour
- not injecting mice that had been treated with living tumour cells some time later.

All students seemed to have knowledge of a controlled experiment but were not necessarily able to design a controlled experiment.

5e–f

Marks	0	1	2	Average
%	15	55	30	**1.2**

5e

Strain Q **or** strain N **or** strain P

Strain Q will result in the production of four different antibodies, strain P will result in the production of three different antibodies and strain N will produce two different antibodies.

If we consider strain N:

- one of the antibodies produced will be effective against strains M, N, P and Q
- the other antibody produced will be effective against strains N and R.

Therefore, if strain N is used then the vaccine will be effective against all strains of the *Staphylococcus* bacteria shown.

By working through in the same way for strains P or Q, the conclusion can be made that they can also be used to produce a vaccine that will be effective against all strains of the *Staphylococcus* bacteria shown.

5f

All five strains – M, N, P, Q and R

A common error made by students was to give four of the strains and leave out the strain they had chosen in their answer to part e.

5g

Marks	0	1	Average
%	57	43	**0.4**

Student X is correct. Although the antibody drawn by student Z would have some effect against strain P, the antibody drawn by student X would be twice as effective because there are twice as many antigens that student X's antibodies can act against.

The most common incorrect response was student Y. Some students seemed to have a limited understanding of the structure of an antibody. An antibody has two antigen binding sites and these two sites are identical within the one antibody. Student Y has drawn an antibody with two different shaped antigen binding sites; this is not an accurate drawing of an antibody and is therefore incorrect. The antibodies drawn by both students X and Z will attach to strain P, as the shape of the antigen binding sites fits onto at least one of the antigens displayed on the surface of strain P. However, student X has drawn the most effective antibody as there are two sites on strain P to which the antibody could attach.