

Unit 3 Biology
Revision Booklet 7 – Solutions

2012 – Question 2

Question 2

Marks	0	1	2	3	4	Average
%	30	16	19	23	12	1.7

One mark each was awarded for:

- three correct labels, such as allergen, antibodies, antibody binding site, cross-linking of allergen, histamines, etc.
- elaboration of terms/labels
- a description of events occurring
- a complete description of the allergic reaction.

This question gave students the opportunity to demonstrate their knowledge and be suitably rewarded for the depth of their response.

The following is an example of a good response.

Antibodies to the allergen are produced by the humoral response. These antibodies bind to the mast cell and act as receptors to the allergen. When the allergen is again encountered, the mast cells release histamines which cause the allergic symptoms such as swelling and itchiness.

2012 – Question 4

Question 4ai.–ii.

Marks	0	1	2	Average
%	10	29	61	1.5

Question 4ai.

Any of:

- B cell/lymphocyte
- plasma cell
- B memory cell
- T_h cell.

A common incorrect answer was T cell.

Question 4aii.

The four-month-old would have a higher level of antibodies.

Students needed to provide a comparative statement and identify the child they were talking about. Many students did not answer the question being asked and instead explained why a four-month-old child would have a higher level of antibodies.

Question 4b.

Marks	0	1	2	Average
%	30	45	25	1

Two of:

- there would be an immediate response
- the response would be greater/more antibodies produced
- antibodies would be produced at a faster rate.

Many students answered this question well, providing clear and concise answers. However, some answers were unclear or the words used were open to interpretation such as, 'The response would be stronger and better'. 'Efficient' was also an inappropriate term.

Question 4ci.–ii.

Marks	0	1	2	Average
%	7	29	64	1.6

Question 4ci.

One of:

- memory cells depleted
- immunisation schedule not completed
- low level of antibodies.

Many students provided valid answers within the scope of the question.

Question 4cii.

One of:

- give booster shots to adults
- Health Department to provide free vaccinations.

This question provided scope for a variety of answers. Students were awarded the mark if they stated, 'Give the adults another vaccination'; however, it was incorrect to suggest 'Give the adults another injection'.

Question 4d.

Marks	0	1	Average
%	62	38	1

This is an example of the humoral immune response where specific antibodies are produced.

Students could also answer the question by correctly describing the cell-mediated response such as, 'The cell-mediated response involves T_c cells and not antibodies'.

2012 – Question 7**Question 7a.**

Marks	0	1	2	Average
%	43	31	25	0.8

Non-cellular (no mark) and two of:

- not made of cells
- does not undergo cellular processes
- only reproduced by a host cell.

Many students provided well-reasoned answers to this question.

Question 7b.

Marks	0	1	2	Average
%	28	29	42	1.2

- Scenario 1 (general viral first line of defence)
Intact skin
Either: secretions of mucus or ciliated epithelia
- Scenario 2 (students acknowledged that the mosquito carries the virus)
Two of: Hair or skin as a physical barrier, or secretions; for example, sweat to deter mosquitoes
- Scenario 3 (students acknowledged that the mosquito breaches first line of defence)
Students needed to include a statement that the skin has been breached and give an example of a defence mechanism, such as cells releasing interferon.

Many answers were accepted for this question. As stated in the stem of the question, Yellow fever is caused by a virus and is transmitted through the bite of a particular species of mosquito, thus bypassing first line of defence mechanisms.

Students were required to answer this question with reference to viruses and not other pathogens, such as bacteria.

Question 7c.

Marks	0	1	2	Average
%	6	32	62	1.6

Prevent the disease entering the Australian population and one of:

- quarantine
- treatment
- test for the presence of the virus.

A variety of answers were acceptable and many students gave well-reasoned responses. Vaccination alone was not accepted as a solution.

2011 – Question 2

Question 2a.

Marks	0	1	2	Average
%	57	26	17	0.6

Both of:

- there will be fewer T cells produced
- a reduced immune response.

This question was poorly answered. Some students discussed the thyroid gland or thought that B cells also matured in the thymus. It is important to note that the decrease in the weight of the thymus does not indicate that adults have 'less need' for their immune system.

Question 2b.

Marks	0	1	2	3	Average
%	29	24	26	21	1.4

Students needed to make points such as:

- (a part of) the poison ivy was identified as foreign/an allergen/an antigen/non-self
- mast cells are activated by the binding of the allergen
- histamines are released or accumulation of fluid causes blisters to form

Students who answered this question in a logical and sequential manner were more likely to do well compared with those who wrote disjointed and often contradictory answers.

Question 2c.

Marks	0	1	Average
%	35	65	0.7

These instructions were given to Paul so that all traces of the poison ivy material could be removed from his body.

An incorrect answer was 'to improve hygiene or reduce infection'.

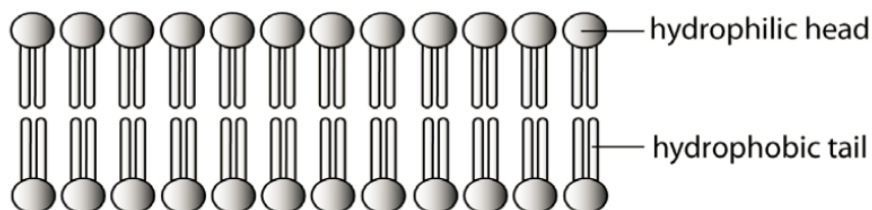
Question 2d.

Marks	0	1	2	Average
%	12	72	16	1.1

Both of:

- to prevent further attack
- to avoid a hypersensitivity reaction/greater response.

2011 – Question 4



For full marks, students needed to provide a suitable and correctly labelled drawing. Most students drew the diagram correctly; however, many added a lot of extra information. It was important that two fatty acid chains were illustrated. Some students' labels were incorrect, some students confused hydrophilic and hydrophobic, and others labelled a glycerol head rather than a phosphate head.

Question 4b.

Marks	0	1	Average
%	30	70	0.7

Alpha helix/ α helix

Secondary structures also include ‘random coil and beta-pleated sheet’. Some students confused these terms and wrote imprecise descriptions.

Question 4c.

Marks	0	1	Average
%	53	47	0.5

A placebo lacks the factor (probiotic) being tested and is used as a control to show the effects of the treatment.

Question 4d.

Marks	0	1	2	Average
%	58	30	11	0.6

Both of:

- the baby would receive passive (natural) immunity from the mother as antibodies would be passed via the placenta/breast milk
- after birth, the baby’s immune system has TLRs stimulated and would therefore not attack self-cells.

Students found the concepts in this question difficult to analyse and interpret. Students who gained full marks demonstrated an excellent understanding of the situation. Some students incorrectly identified the immunity from the mother as ‘active’.

Question 4e.

Marks	0	1	2	Average
%	32	31	38	1.1

Examples of factors that would need to be controlled are (two of):

- food/water availability
- enclosure/housing conditions
- health/age of mice.

Many students incorrectly stated the probiotic versus the placebo; this is the independent variable. Some students gave more than two answers.

It is important to reinforce that when the question specifically asks for an experiment on mice, this must be used. Rats are a different species.

2010 – Question 4**Question 4a.**

Marks	0	1	2	Average
%	37	31	32	1

Strain Z has the most plasma cells; therefore, more antibodies can be produced against the influenza virus.

A comparative statement was required when referring to strain Z. Its introduction of more plasma cells needed to be compared with the production of plasma cells by cells X and Y.

Question 4b.

Marks	0	1	2	Average
%	48	37	15	0.7

Both of:

- blocking the receptors has the same effect as having no receptors, as is the situation with cell Y
- the most memory cells are produced by cell Y.

Many students restated the stem of the question saying that blocking the action of EB12 receptors could result in the production of a more efficient vaccine, and did not provide an explanation.

2010 – Question 7

Question 7a.

Marks	0	1	Average
%	26	74	0.8

Autoimmune (disease)

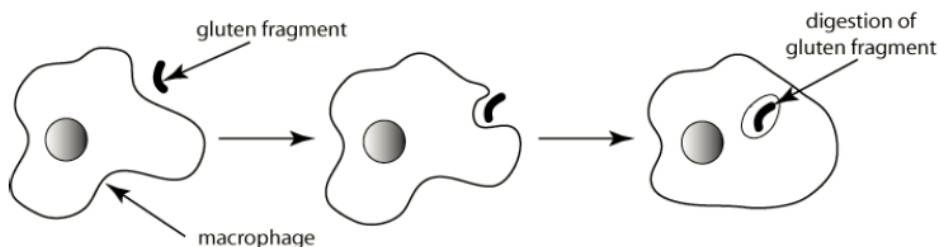
Autoimmune deficiency disease is incorrect. AIDS is an example of this type of disease and it is **not** an autoimmune disease.

Question 7b.

Marks	0	1	2	Average
%	25	50	24	1

Both of:

- macrophages engulf the gluten fragment (or a diagram showing this)
- the fragment is digested by enzymes/lysosomes.



This question was generally well answered and students who chose to draw a diagram provided a suitable one.

Question 7c.

Marks	0	1	2	Average
%	43	23	34	0.9

One of:

- cytotoxic T cell: kills infected epithelial cells
- B cells: these cells differentiate into memory and plasma cells to produce antibodies against epithelial cells
- interleukins/cytokines: these stimulate specific immune response against epithelial cells.

Many answers given were unsuitable, such as NK cells, histamines or mast cells.

Question 7d.

Marks	0	1	2	Average
%	10	17	73	1.7

Examples of correct answers included:

- are there any known side effects?
- should it be taken with food?
- will I be paid for this?
- will I be compensated if things go wrong?
- is it subsidised by the government?

The responses provided varied greatly. In general, students did really well. Unsuitable responses included 'Is it safe for humans?', a repetition of the question stem, or both responses being variations of each other.

2010 – Question 8

Question 8a.

Marks	0	1	Average
%	74	26	0.3

Two years – this was from peak to peak

Question 8b.

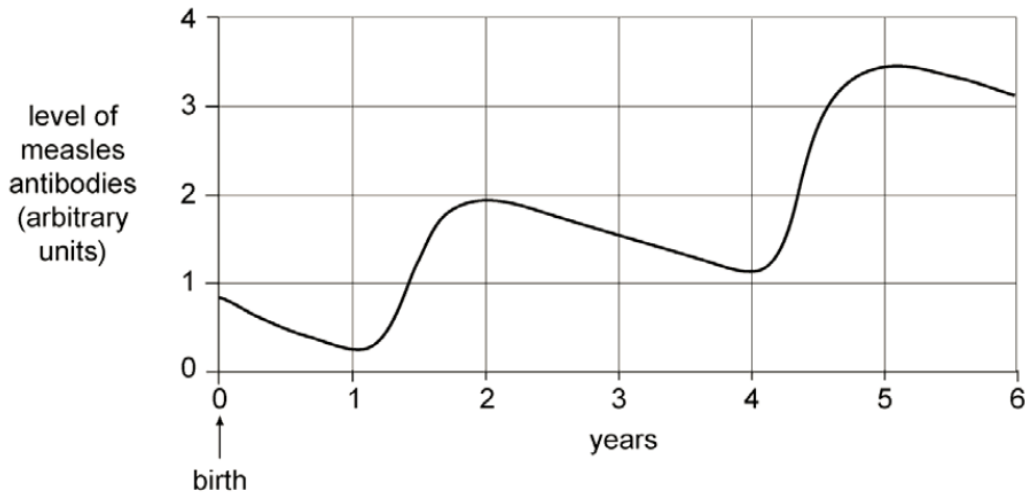
Marks	0	1	2	Average
%	33	39	28	1

Both of:

- the child has measles
- the child should be isolated from other family members or they should be vaccinated.

Question 8c.

Marks	0	1	2	Average
%	40	36	24	0.9



The graph needed to originate above 0 on the Y axis. There needed to be two distinct peaks, the first after 1 year and the second being greater after 4 years. The rise had to start after 1 and 4 years, not the peak at these times.

Question 8d.

Marks	0	1	2	Average
%	25	35	41	1.2

Both of:

- Mrs Smith's embryo is at greater risk as it is at a critical stage of development
- abnormalities occur in one or more of the nervous system/eyes/ears/heart.

2009 – Question 7**Question 7a.**

Marks	0	1	Average
%	49	51	0.5

B lymphocyte

Question 7bi-ii.

Marks	0	1	2	Average
%	45	40	15	0.7

Question 7bi.

B plasma cell

Question 7bii.To produce **specific** antibodies

Question 7ci-ii.

Marks	0	1	2	Average
%	41	29	30	0.9

Question 7ci.

B memory cell

Question 7cii.

To **rapidly** produce antibodies if the infection recurs at a later date

Question 7d.

Marks	0	1	Average
%	52	48	0.5

Students could accurately name any autoimmune disease, including (but not limited to):

- type 1 diabetes (not simply 'diabetes')
- rheumatoid arthritis (not simply 'arthritis')
- multiple sclerosis.

Some students gave AIDS as their answer, however this is **not** an autoimmune disease.

Question 7e.

Marks	0	1	2	Average
%	32	14	54	1.2

Both of:

- self cells are detected as foreign by the person's own immune system
- the immune system attacks misidentified cells.

This question was generally well answered, however some students described the effects of an autoimmune disease in Question 7d. rather than Question 7e. Some students stated 'The body could not distinguish between self and non self cells'; this is incorrect as the key point is that the body detects self **as** non self cells.

2008 – Question 5**Question 5**

This question was one of the most challenging questions on the examination. It highlighted students' confusion between the cell mediated and humoral immune responses.

Question 5a.

Marks	0	1	2	Average
%	38	44	18	0.8

5ai.

Any one of:

- T-helper cells
- macrophages/phagocytes
- antigen presenting cells.

5aii.

The cells mentioned in part i. have receptors that are capable of detecting self markers and/or non-self antigens.

Question 5b.

Marks	0	1	2	Average
%	71	19	10	0.4

Both of:

- in the cell mediated immune response, T-cell mediated rejection response occurs and T-helper cells activate cytotoxic T-cells and/or NK (natural killer) cells
- cytotoxic chemicals are produced which destroy foreign cells **or** macrophages engulf and destroy foreign material.

Most students incorrectly treated this question as a humoral immune response, while others mentioned all possible types of cells involved in immune responses and therefore did not score any marks. Students should use the correct terms for T-cells; either cytotoxic, helper or NK (natural killer) cells, not, for example, 'killer T-cells'.

Question 5c.

Marks	0	1	Average
%	61	39	0.4

The tumour cells lack antigens/have the same markers as the previously uninfected Tasmanian devil and are therefore not recognised as non-self.

A common incorrect answer was simply stating that 'the tumours were accepted as the Tasmanian devils were related'.

Question 5d.

Marks	0	1	Average
%	45	55	0.6

Either of:

- yes, the tumour is contagious and brings about a diseased state
- no, the tumour is not an organism but cells originating from rogue self cells.

The explanation was the key part required in the answer.

2007 – Question 2

Question 2

This question required students to recall definitions and apply knowledge based on the information provided.

Question 2a.

Marks	0	1	2	Average
%	22	38	40	1.2

ai.

Phagocytes are a type of lymphocyte which are able to:

- recognise, engulf and destroy foreign material such as pathogens
- engulf antibody-antigen complex
- display the antigens of ingested pathogens to trigger an immune response.

Any one of the above responses was acceptable.

aii.

Complement proteins:

- attach to invading micro-organisms
- make it easier for phagocytes to ingest
- lyse plasma membranes of pathogens, **not** cell walls
- promote inflammation.

Any one of the above responses was acceptable.

Part ii. was poorly answered. Many students incorrectly stated that complement proteins were cells; others gave varied, incorrect suggestions with no relevance to an immune response.

Question 2b.

Marks	0	1	2	Average
%	19	39	42	1.3

bi.

Cell R

bii.Cell R has **more** non-self antigens than cells P or Q.

Many students incorrectly stated that cell R has more receptors. Careful reading of the information would have avoided this mistake. Students are advised that whenever a comparison is required, they need to make a comparative statement, rather than only mentioning one situation.

2007 – Question 5**Question 5a.**

Marks	0	1	Average
%	33	67	0.7

Suitable allergens included:

- pollen
- food (for example, peanuts)
- dust mites.

Incorrect answers included food, with no example given, dust and fur. Some students named a condition caused by the allergen; for example, asthma or hay fever. They were not awarded the mark.

Question 5b.

Marks	0	1	2	Average
%	28	35	37	1.1

bi.

Either of:

- rough endoplasmic reticulum
- ribosomes.

Students are advised that they should use the term 'rough endoplasmic reticulum' rather than non-standard abbreviations such as RER or Rough ER. Use of non-standard shortcuts may result in marks not being awarded.

bii.

The rough endoplasmic reticulum produces antibodies.

Many students made vague statements such as 'produce proteins', or incorrectly referred to Cell K; these students did not obtain the mark.

Question 5c.

Marks	0	1	2	3	4	Average
%	18	18	20	23	20	2.1

ci.

Either of:

- Mast Cell
- Basophil.

'Mask cell' was not awarded a mark.

cii.

Some suitable regions of the body are:

- skin, nose or connective tissue
- a specific organ of the digestive system (for example, the stomach)
- muscles in blood vessels.

Unacceptable answers included blood and muscles.

ciii.

Some suitable effects of the release of histamines included:

- swelling
- itching
- excessive mucus production
- constriction of airways.

civ.

Exocytosis

This was answered well. A common incorrect answer was secretion.

2006 – Question 7

Question 7a.

Marks	0	1	2	Average
%	18	49	33	1.2

ai.

There were many possible answers to this question, including: waxy layers on outside surface; intact or thick cuticle; and chemicals that repel potential pathogens such as insects.

aii.

Some examples of appropriate answers include: intact skin; chemicals (enzymes) in tears of eyes/mouth; mucus in nose, respiratory system and intestine; and pH and digestive enzymes in intestine.

Cell wall and cell membrane respectively for parts i. and ii. were not accepted.

Question 7b.

Marks	0	1	Average
%	53	47	0.5

A plant could respond by:

- growing 'gall' tissue around the area containing the infective agent to prevent spread to other areas
- producing chemicals such as tannins
- producing 'gum' to seal off the wounded area
- dropping the infected part (leaf) to inhibit spread to other parts.

One of the above answers was required. Some students failed to take into account that the infection had occurred and therefore gave inappropriate answers.

Question 7c.

Marks	0	1	2	Average
%	31	43	26	1.0

Some examples of acceptable features include: presence of phagocytes; increase in blood flow to area of infection; chemicals released by damaged cells; clot or scab forms at infective area; and increased permeability of capillaries allows free movement of white blood cells.

Two features were requested, therefore students needed to clearly state and describe the two features they were writing about. The most common error was for students to write an extended and unspecific comment on inflammation in the space for the first feature, but leave the second space blank.

Question 7d.

Marks	0	1	Average
%	62	38	0.4

Immune system cells have receptors that are able to distinguish the different kinds of (MHC) on all cells and hence have the ability to detect and distinguish self from non-self.

Insufficient knowledge about this feature often led to incomplete answers.

Question 7e.

Marks	0	1	Average
%	26	74	0.8

Antibodies

Question 7f.

Marks	0	1	2	Average
%	44	43	13	0.7

Although many students understood that mast cells release histamines, they failed to receive the mark allocated for the idea that allergens react with specific IgE antibodies which are attached to mast cells and cause the rupture of the mast cells.

IgE antibodies are important players in allergy reactions.