Government of South Australia

SACE Board of SA

External Examination 2016

2016 BIOLOGY

Monday 14 November: 9 am

Pages: 12
Questions: 25

Multiple-choice Question Booklet

Write your answers to Section A: Multiple-choice Questions on the separate blue multiple-choice answer sheet.

SECTION A: MULTIPLE-CHOICE QUESTIONS (Questions 1 to 25)

(50 marks)

*Answer **all** questions in this section.*

*Each of the twenty-five multiple-choice questions in Section A involves choosing from four alternative answers. Read each question carefully. Then indicate the **one** alternative that you consider best answers the question by shading the bubble by the appropriate letter alongside the question number on the blue multiple-choice answer sheet. Use black or blue pen. It is in your interest to give an answer to every question in this section of the paper, as no marks are deducted for incorrect answers. Each question is worth 2 marks. You should spend about 40 minutes on this section.*

1. Scientists are able to identify any particular chromosome because each chromosome

   J. has genes that are specific to it.

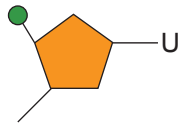
   K. is made up of many genes.

   L. codes for a specific polypeptide.

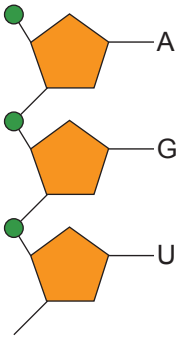
   M. is made up of a different amino acid sequence.

2. Which one of the following diagrams shows **one** RNA codon?

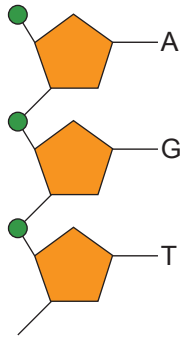
J.



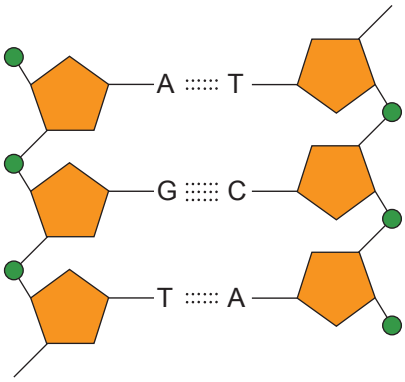
K.



L.



M.



3. The most common polysaccharide in plant cell walls is

   J. cellulose.

   K. glycogen.

   L. starch.

   M. chitin.

4. Which one of the following statements does ***not*** describe an example of proteins in a cell membrane allowing the cell to recognise and select molecules?

   J. Surface proteins of a white blood cell adhere to the surface proteins of a bacterial cell.

   K. Channel transport proteins allow water to move into cells to regulate the internal cellular environment.

   L. Hormones bind to surface proteins and this stimulates a series of cellular events.

   M. Transport proteins pump sodium ions in one direction and potassium ions in the opposite direction across the cell membrane.

5. *Refer to the following table, which shows the base sequence for the same short section of DNA in four species of tropical fish and their common ancestor:*

Source: J.L. Carlin 2011, 'Mutations Are the Raw Materials of Evolution', *Nature Education Knowledge*, 3(10), p 10, Scitable by Nature Education, viewed 16 August 2016, www.nature.com/scitable/

According to the information above, which species was the first to separate from the common ancestor?

   J. *Epinephelus miliaris*.

   K. *Epinephelus nigritus*.

   L. *Mycteroperca tigris*.

   M. *Plectropomus leopardus*.

6. The dark colouring of a cat is the result of a chemical reaction controlled by the enzyme tyrosinase.

   The form of tyrosinase in Siamese cats denatures at normal body temperature and therefore only the cooler extremities of the cat become dark. These extremities include the nose and mouth, the tail, the paws, and the ears, as shown in the photograph below:

Source: © Vasiliy Koval | Dreamstime.com

   Under normal conditions, Siamese kittens are born with white fur and as they get older the fur on their extremities darkens.

   Which one of the following statements describes the colouring of a Siamese cat that had lived in colder than normal conditions since it was a kitten?

   J. The cat's body and extremities would have light-coloured fur.

   K. The cat's extremities would have dark-coloured fur as shown above.

   L. The cat's extremities would have more dark-coloured fur than the cat shown above.

   M. The cat's body would have dark-coloured fur, whereas the cat's extremities would have light-coloured fur.

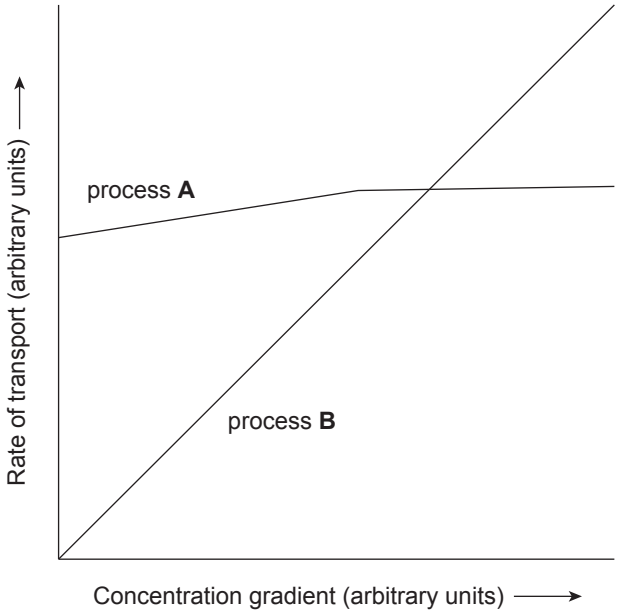
7. Which one of the following combinations of conditions promotes cell division of **normal** human cells in cell culture?

	Conditions		
	Hormones	*Light*	*Oxygen*
J.	present	present	absent
K.	absent	absent	absent
L.	present	absent	present
M.	absent	present	present

8. Which one of the following combinations matches a type of cell, its typical size, and the presence or absence of membrane-bound organelles?

	Type of cell	*Typical size of the cell (μm)*	*Membrane-bound organelles*
J.	prokaryotic	10–100	present
K.	eukaryotic	10–100	absent
L.	prokaryotic	1–10	absent
M.	eukaryotic	1–10	present

9. *Refer to the following graph, which shows the relationship between the concentration gradient of a substance and the rate of its transport across a cell membrane by two different processes,* **A** *and* **B***:*



Based on the information in the graph,

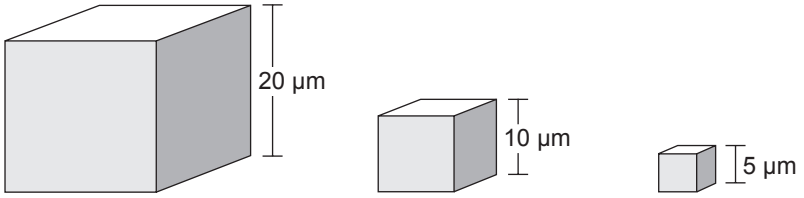
J. process **B** is active transport because, as the concentration gradient increases, the rate of transport also increases.

K. process **A** is osmosis because, as the concentration gradient increases, the rate of transport becomes constant.

L. process **A** is diffusion because the concentration gradient has no effect on the rate of transport.

M. process **B** is diffusion because, as the concentration gradient increases, the rate of transport also increases.

10. *Refer to the following diagrams of cubes, which represent different sized cells,* **A**, **B**, *and* **C**:



Which one of the following statements identifies the relative efficiency of these cells in the exchange of materials?

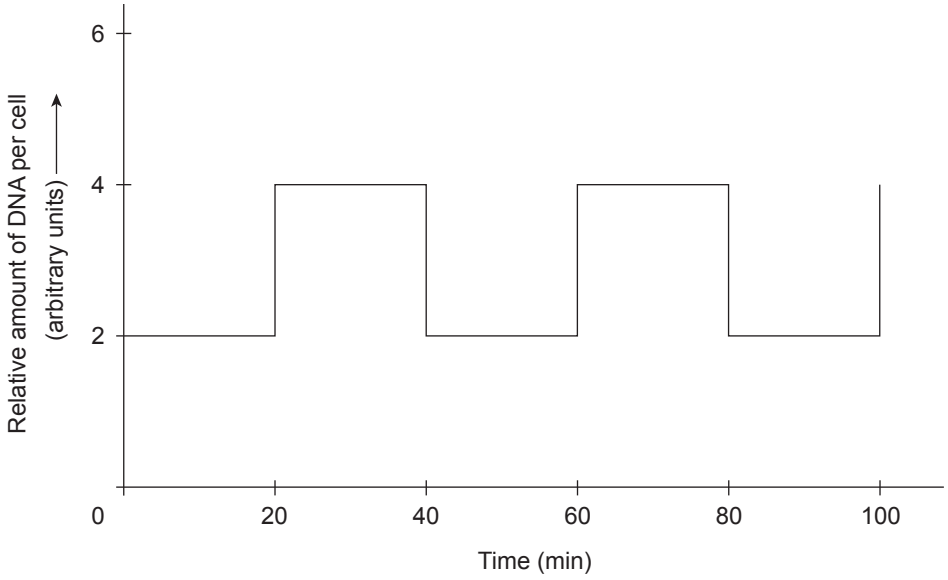
J. Cell **A** is more efficient than cell **B**, but less efficient than cell **C**.

K. Cell **B** is less efficient than cell **A**, but more efficient than cell **C**.

L. Cell **A** is less efficient than cell **B** and cell **C**.

M. Cell **C** is less efficient than cell **A** and cell **B**.

11. *Refer to the following graph, which shows the change in the relative amount of DNA per cell in a growing bacterial colony over a 100-minute period:*



Which one of the following statements explains the changes in the relative amount of DNA per cell shown in the graph?

J. At 20 minutes and 100 minutes the bacterial cells undergo binary fission, and this halves the amount of DNA in each cell.

K. At 40 minutes and 80 minutes the amount of DNA in each bacterial cell doubles, enabling new cells with identical DNA to be produced.

L. At 20 minutes and 60 minutes the amount of DNA in each bacterial cell doubles, enabling the new cells to receive an identical copy of DNA.

M. At 40 minutes and 80 minutes the bacterial cells undergo meiosis, and this halves the amount of DNA in each cell.

12. The cells of a mouse have a diploid number of 40.

Which one of the following combinations identifies the number of chromosomes in a sperm cell, a liver cell, and a fertilised egg cell of a mouse?

	Number of chromosomes in cells of a mouse		
	Sperm cell	*Liver cell*	*Fertilised egg cell*
J.	40	20	40
K.	20	40	40
L.	20	40	20
M.	40	80	80

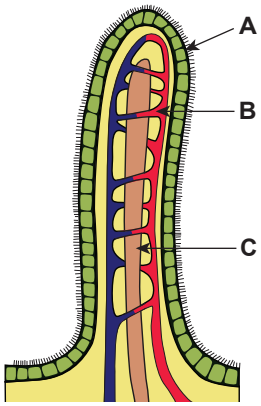
13. *Refer to the following partial chemical equation for a process that occurs in cells:*

$$C_6H_{12}O_6 + 6O_2 \longrightarrow \text{product(s)}$$

Which one of the following combinations identifies the product(s) formed and a type of cell that produces the product(s)?

	Product(s)	*Type of cell*
J.	water and carbon dioxide	plant
K.	lactic acid	animal
L.	ethanol and carbon dioxide	plant
M.	lactic acid and carbon dioxide	animal

14. *Refer to the following diagram, which shows a structure in the human small intestine:*



Which one of the following statements is ***not*** correct?

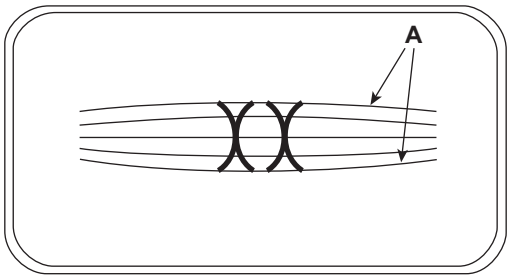
J. Structure **C** is part of the lymphatic system and transports lipids.

K. Diffusion distance is decreased because structure **B** is close to structure **A**.

L. Glucose molecules move by diffusion and active transport into structure **A**.

M. Microvilli on structure **B** increase its surface area.

15. *Refer to the following diagram, which shows a dividing cell:*



The structures labelled **A** are a component of the

J. endoplasmic reticulum.

K. cytoskeleton.

L. chromosomes.

M. internal membranes of a chloroplast.

16. Yeast cells supplied with glucose are moved from an aerobic environment to an anaerobic environment.

The amount of energy released by the yeast cells is

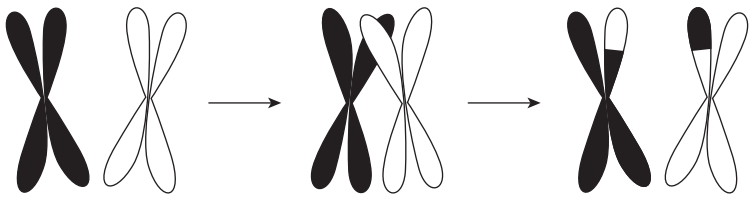
J. greater in the anaerobic environment than in the aerobic environment when new bonds are formed.

K. less in the anaerobic environment than in the aerobic environment.

L. greater in the anaerobic environment than in the aerobic environment when bonds are broken.

M. the same in the aerobic environment and the anaerobic environment.

17. *Refer to the following diagram, which shows an event that occurs during meiosis:*



The diagram shows

J. crossing over of non-homologous chromosomes.

K. independent assortment of homologous chromosomes.

L. independent assortment of sister chromatids.

M. crossing over of non-sister chromatids.

18. *Refer to the following diagram, which shows nerve pathways involved in the detection of light by human beings:*

Awaiting copyright approval.

Source: Based on a diagram created by John Yaw-Jong Tsai, Touro University

In healthy eyes, the reactions of the pupils in the right and left eyes are linked. A bright light shone into one eye leads to an equal constriction of both pupils.

In which one of the following circumstances will only the pupil of the right eye constrict when bright light is shone into the left eye?

J. The optic nerve connected to the right eye is not functioning.

K. The optic nerve connected to the left eye is not functioning.

L. The third cranial nerve connected to the right eye is damaged.

M. The third cranial nerve connected to the left eye is damaged.

19. Which one of the following statements describes a process that requires the expenditure of cellular energy?

J. The movement of water from the soil into the root hair cells of a plant.

K. The diffusion of sodium ions across a neuron membrane as part of nerve communication.

L. The uptake of oxygen from the air through the surface of the eye.

M. The maintenance of a stable environment in a liver cell.

20. *Refer to the following photographs, which show two species of lizard:*

Egernia saxatilis intermedia
Photographer: Peter Robertson © Museum Victoria

Egernia whitii
Photographer: Peter Robertson © Museum Victoria

Lizards from each of these species living together in the same national park would belong to

J. different populations but the same ecosystem.

K. the same population and the same ecosystem.

L. the same population but different ecosystems.

M. different populations and different ecosystems.

21. The mosquito *Culex pipiens molestus* is found in underground train tunnels and stations in London. It is thought to be related to *Culex pipiens pipiens*, a species of mosquito that lives above the ground, although some evidence suggests that it is a different species.

Which one of the following observations would provide the best evidence that these mosquitoes are different species?

J. When the two varieties of mosquito are cross-bred, the eggs are infertile.

K. *Culex pipiens molestus* breeds all year round but *Culex pipiens pipiens* is inactive during winter.

L. A fertile hybrid of these two mosquito varieties exists.

M. *Culex pipiens molestus* bites human beings, rats, and mice, but *Culex pipiens pipiens* bites only birds.

22. The bacterium *Mycobacterium tuberculosis* is resistant to the antibiotic penicillin. In northern Asia, this resistance is due to the presence of an enzyme known as CTX-M-1.

In Australia, this resistance is due to the presence of a similar enzyme, CTX-M-15.

The sources of the two different enzymes CTX-M-1 and CTX-M-15 are

J. different mutations that occurred in the bacteria from northern Asia and Australia.

K. different types of penicillin that were used in northern Asia and Australia.

L. different selection pressures that acted in northern Asia and Australia.

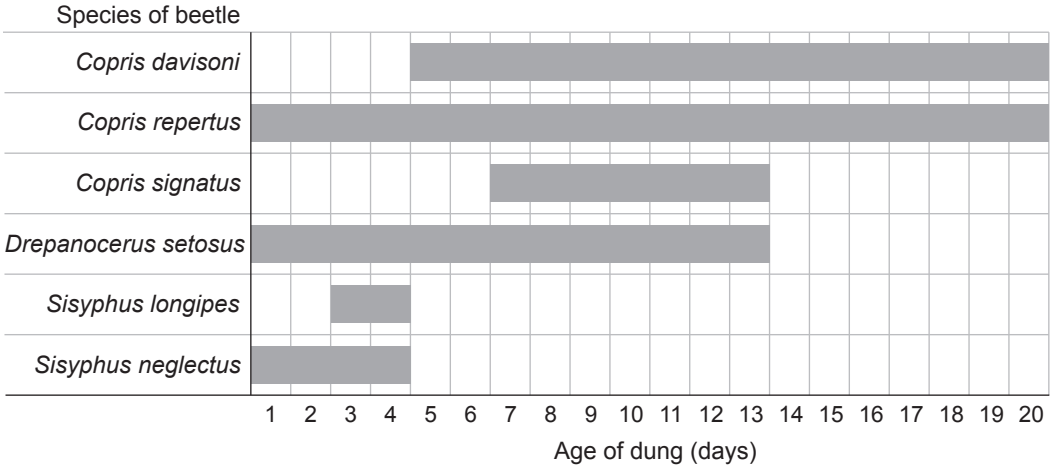
M. different environments of the people who became infected in northern Asia and Australia.

23. Which one of the following combinations identifies one of the functions carried out by organisms from each of three trophic levels in an ecosystem?

	Trophic level		
	Producer	*Consumer*	*Decomposer*
J.	provides energy for other organisms	uses chemical energy to perform cellular processes	recycles energy and nutrients
K.	converts light energy to chemical energy	obtains energy from other organisms	recycles energy and nutrients
L.	uses chemical energy to perform cellular processes	provides energy for other organisms	breaks down organic substances
M.	obtains energy from other organisms	uses chemical energy to perform cellular processes	breaks down organic substances

24. The species of beetle found on animal dung that is deposited in the wild change over time.

Refer to the following diagram, which shows the species of beetle most likely to be on dung of different ages:



Source: Adapted from T.K. Sabu, K.V. Vinod, and P.J. Vineesh 2006, 'Guild structure, diversity and succession of dung beetles associated with Indian elephant dung in South Western Ghats forests', *Journal of Insect Science*, figure 4, viewed 29 July 2016, http://jinsectscience.oxfordjournals.org

A scientist found dung with *Copris repertus*, *Drepanocerus setosus*, *Sisyphus longipes*, and *Sisyphus neglectus* on it. *Copris davisoni* and *Copris signatus* were not on the dung.

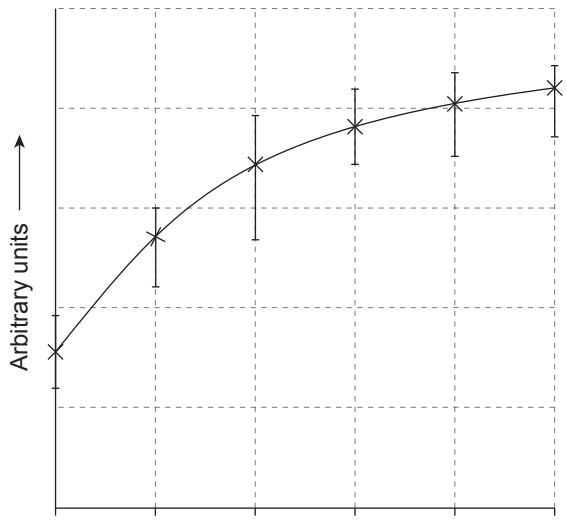
Which one of the following combinations identifies the age of the dung and a reason for the change in the mix of beetle species on the dung over time?

	Age of dung (days)	*Reason for change in mix of species over time*
J.	3	speciation
K.	3	succession
L.	13	speciation
M.	13	succession

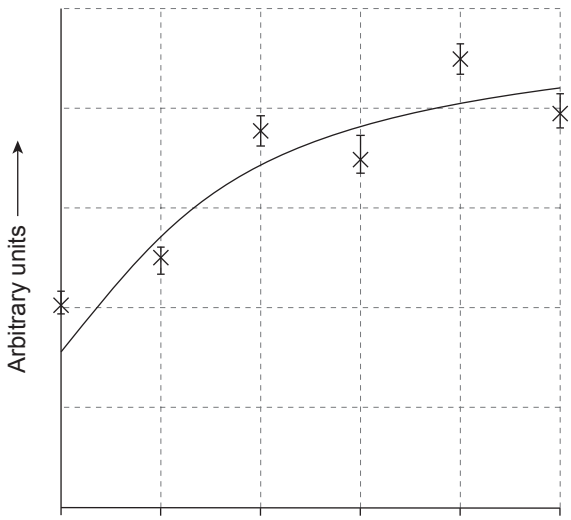
25. *Refer to the following two graphs, which show the results from two identical investigations (**A** and **B**). In each investigation five measurements were taken each hour for 5 hours. The average of each set of five measurements is shown on the graphs as ×. The range of results within each set of five measurements is illustrated by ⌶.*

Each graph shows the line of best fit that was determined using the average measurements for one investigation. The line of best fit is the same for both investigations.

Investigation A



Investigation B



The results of investigation **A** are

J. more accurate than the results of investigation **B**.

K. less precise than the results of investigation **B**.

L. less accurate than the results of investigation **B**.

M. more precise than the results of investigation **B**.

1

Government of South Australia

SACE Board of SA

External Examination 2016

2016 BIOLOGY

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ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

QUESTION BOOKLET

1

10 pages, 3 questions

Monday 14 November: 9 am

Time: 3 hours

Section B: Short-answer Questions

Part 1

Examination material: Question Booklet 1 (10 pages)
Question Booklet 2 (9 pages)
Question Booklet 3 (8 pages)
Multiple-choice Question Booklet (12 pages)
one blue multiple-choice answer sheet
one SACE registration number label

Approved dictionaries and calculators may be used.

Instructions to Students

1. You will have 10 minutes to read the paper. You must not write in your question booklets, or on your blue multiple-choice answer sheet, or use a calculator during this reading time, but you may make notes on the scribbling paper provided.

2. This paper is in three sections: Section A is in the Multiple-choice Question Booklet; Part 1 of Section B is in Question Booklet 1; Part 2 of Section B is in Question Booklet 2; and Section C is in Question Booklet 3.

   Section A: Multiple-choice Questions (Questions 1 to 25)
   Answer Section A on the separate blue multiple-choice answer sheet, using black or blue pen.
   Answer ***all*** questions in Section A.

   Section B: Short-answer Questions (Questions 26 to 33)
   Answer ***all*** Part 1 of Section B (Questions 26 to 28) in the spaces provided in Question Booklet 1.
   Write on page 10 of Question Booklet 1 if you need more space.

   Answer ***all*** Part 2 of Section B (Questions 29 to 33) in the spaces provided in Question Booklet 2.
   Write on page 9 of Question Booklet 2 if you need more space.

   Section C: Extended-response Questions (Questions 34 and 35)
   Answer ***both*** questions in Section C in Question Booklet 3.
   Write on page 8 of Question Booklet 3 if you need more space.

3. In Section B there is no need to fill all the space provided; clear, well-expressed answers are required. If you delete part or all of an answer you should clearly indicate your final answer and label it with the appropriate question number.

4. The allocation of marks and suggested allotment of time are as follows:

Section A	50 marks	40 minutes
Section B	120 marks	110 minutes
Section C	30 marks	30 minutes
Total	200 marks	180 minutes

5. Attach your SACE registration number label to the box at the top of this page. Copy the information from your SACE registration number label into the boxes on your blue multiple-choice answer sheet and on the front covers of Question Booklets 2 and 3.

6. At the end of the examination, place Question Booklets 2 and 3, and your blue multiple-choice answer sheet, inside the back cover of Question Booklet 1.

STUDENT'S DECLARATION ON THE USE OF CALCULATORS

By signing the examination attendance roll I declare that:

- my calculators have been cleared of all memory
- no external storage media are in use on these calculators.

I understand that if I do not comply with the above conditions for the use of calculators I will:

- be in breach of the rules
- have my results for the examination cancelled or amended
- be liable to such further penalty, whether by exclusion from future examinations or otherwise, as the SACE Board of South Australia determines.

SECTION B: SHORT-ANSWER QUESTIONS (Questions 26 to 33)

(120 marks)

*You should spend about 110 minutes on this section. Answers may be in note form. The allocation of marks is shown in brackets at the end of each part of each question. Answer **all** questions in the spaces provided.*

Part 1 (Questions 26 to 28)

(60 marks)

26. Gaucher disease is an inherited illness caused by a mutation on the human *GBA* gene that codes for the human GCR enzyme.

(a) State one factor that could increase the mutation rate of a gene such as *GBA*.

_____ (2 marks)

The most common mutation in the DNA of people with Gaucher disease results in a change to one amino acid in the polypeptide chain.

(b) Describe how a single change in the DNA sequence of a gene results in a change to one amino acid in the polypeptide chain that the gene codes for.

_____

_____

_____

_____

_____ (4 marks)

The human body needs GCR in order to break down a lipid called glucocerebroside into glucose and ceramide, a short lipid molecule. If glucocerebroside is not broken down, it accumulates in the liver, spleen, and bone marrow. The effects of this accumulation include pain, fatigue, jaundice, bone damage, and anaemia.

(c) State one important role of lipids in cells.

_____ (2 marks)

(d) With reference to the induced-fit model of enzyme–substrate binding, describe how an enzyme such as GCR breaks down its substrate.

_____

_____

_____

_____

_____ (4 marks)

One treatment for Gaucher disease is enzyme replacement therapy. The human *GBA* gene is removed from the cells of a healthy person and inserted into a bacterial plasmid, which is then used to transfer the *GBA* gene to the ovary cells of Chinese hamsters (CHO). The recombinant CHO cells are grown in culture and produce the human GCR enzyme, which is used to treat a person with Gaucher disease.

(e) Describe the process used to remove the human *GBA* gene and insert it into a bacterial plasmid.

_____

_____

_____

_____

_____ (4 marks)

(f) Explain one **benefit to society** of enzyme replacement therapy.

_____

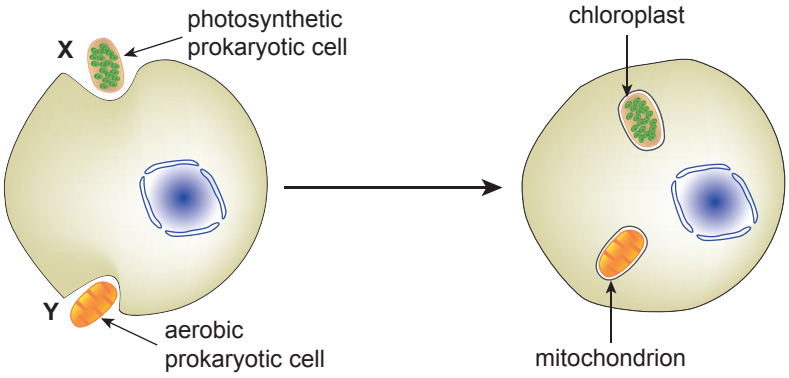
_____

_____

_____

_____ (4 marks)

27. *Refer to the following diagram, which represents one explanation for the evolution of eukaryotic cells:*



[*This diagram is not drawn to scale.*]

(a) State the name of the process illustrated in the diagram above.

_____ (2 marks)

(b) Explain one piece of evidence to support the idea that eukaryotic cells evolved from prokaryotic cells.

_____

_____

_____

_____

_____ (4 marks)

(c) Describe the changes that occur in the cell membrane at **X** and **Y** in the diagram above.

_____

_____

_____

_____

_____ (4 marks)

The precursors of chloroplasts and mitochondria are thought to have been capable of independent life before their inclusion in eukaryotic cells. Therefore they would have been able to produce their own enzymes.

(d) Name the process by which cells produce enzymes.

_____ (2 marks)

(e) Describe the process that occurs in the cytoplasm of a eukaryotic cell and produces enzymes.

_____

_____

_____

_____

_____ (4 marks)

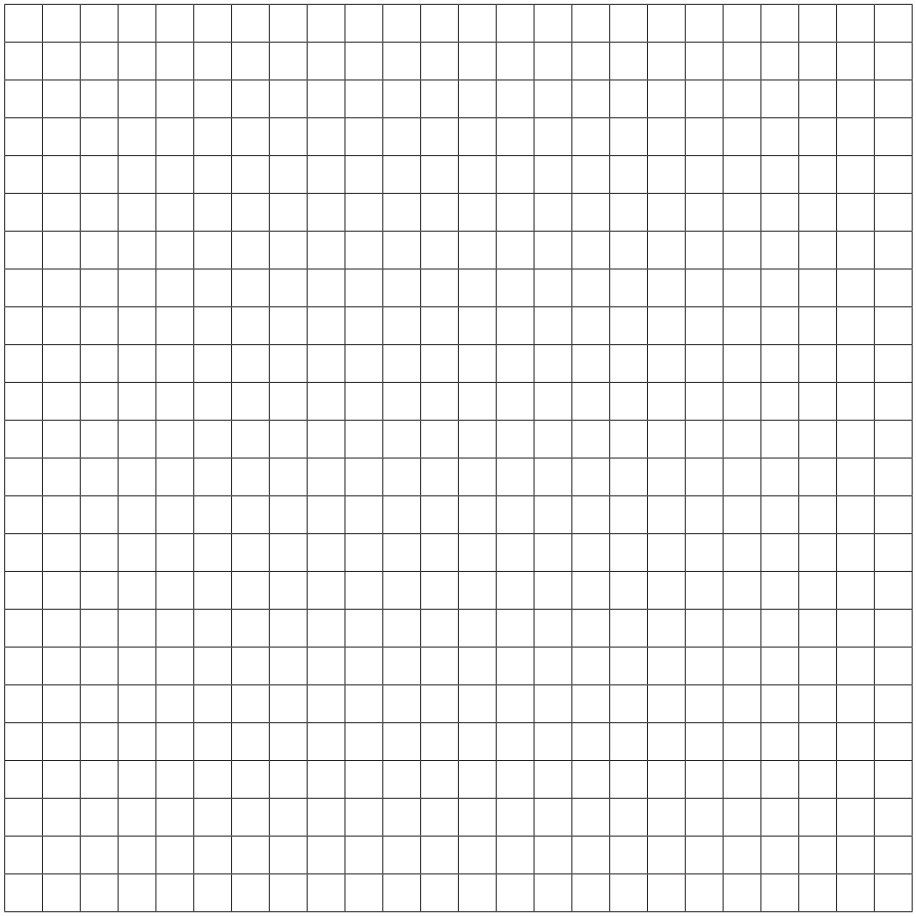
(f) To determine the rate of enzyme production in mitochondria, scientists designed an experiment using a radioactively labelled amino acid, ^{35}S-methionine.

The rate of enzyme production can be calculated by measuring how much ^{35}S-methionine was incorporated in enzymes produced in the mitochondria.

Refer to the following table, which shows the amount of ^{35}S-methionine incorporated in enzymes produced in mitochondria during 60 minutes:

Time (min)	*Amount of ^{35}S-methionine incorporated (dpm per mg enzyme)*
10	2500
20	4500
30	6000
40	7500
50	9500
60	12000

(i) On the grid below, graph the data from the table on page 6.



(4 marks)

(ii) Describe the pattern of incorporation of ^{35}S-methionine in enzymes produced in the mitochondria during the 60 minutes.

_____

_____

_____ (2 marks)

(iii) State two factors that would need to be held constant during the experiment.

Factor 1: _____

Factor 2: _____ (4 marks)

(iv) Calculate the rate of incorporation of ^{35}S-methionine at 60 minutes.

_____dpm per mg/min (2 marks)

28. Growth factors are proteins that bind to receptors on the cell membrane and are involved in the regulation of the cell cycle.

(a) Describe the structure of the cell membrane.

_____

_____

_____

_____

_____ (4 marks)

(b) State the effect of an abnormally high level of growth factor on a:

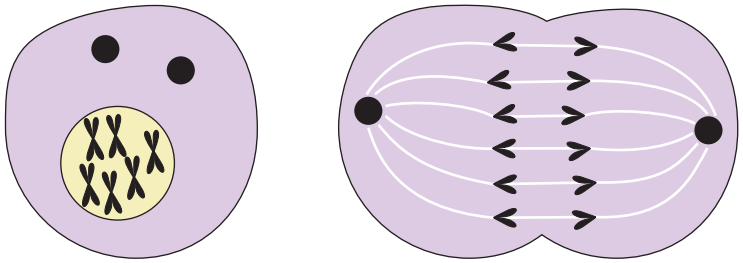
(i) cell. _____

_____ (2 marks)

(ii) multicellular organism. _____

_____ (2 marks)

(c) *Refer to the following diagrams, which show two phases of cell division:*



Phase 1 **Phase 2**

[*This diagram is not drawn to scale.*]

State one feature of cell division that occurs during:

(i) phase 1. _____

_____ (2 marks)

(ii) phase 2. _____

_____ (2 marks)

You may write on this page if you need more space to finish your answers to any questions in Part 1 of Section B. Make sure to label each answer carefully (e.g. 26(e) continued).

Government of South Australia

SACE Board of SA

External Examination 2016

2016 BIOLOGY

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SEQ | FIGURES | CHECK LETTER | BIN

BIOLOGY

QUESTION BOOKLET

2

9 pages, 5 questions

Monday 14 November: 9 am

Section B: Short-answer Questions

Part 2

Write your answers to Part 2 of Section B in this question booklet.

2

SECTION B: SHORT-ANSWER QUESTIONS

Part 2 (Questions 29 to 33)

(60 marks)

*Answer **all** questions in the spaces provided.*

29. In June 2008 a team led by Professor Paolo Macchiarini at University of Barcelona in Spain carried out the first transplant using an organ grown from the recipient's own stem cells.

Source: P. Macchiarini 2008, 'First tissue-engineered whole-organ transplant', AnimalResearch.Info, viewed 20 June 2016, http://www.animalresearch.info/en

A piece of the donor's trachea was treated to remove all of the donor's cells, leaving a tubular cartilage scaffold. Bone marrow stem cells were taken from the recipient and grown under conditions that caused them to develop into chondrocytes (cartilage cells). The chondrocytes were then embedded in the scaffold, which was transplanted into the recipient.

(a) State the name of the organ system to which the trachea belongs.

_____ (2 marks)

(b) Explain how bone marrow stem cells develop into chondrocytes.

_____

_____

_____

_____

_____ (4 marks)

(c) How does the genetic information in the recipient's bone marrow stem cells compare with the genetic information in the chondrocytes that develop from the recipient's bone marrow stem cells?

_____ (2 marks)

(d) Draw a labelled diagram of a human alveolus and a blood vessel that is associated with it.

(4 marks)

(e) Some drugs enter the body via the alveoli.

Discuss how choices about drug-use can affect the well-being of individuals.

_____

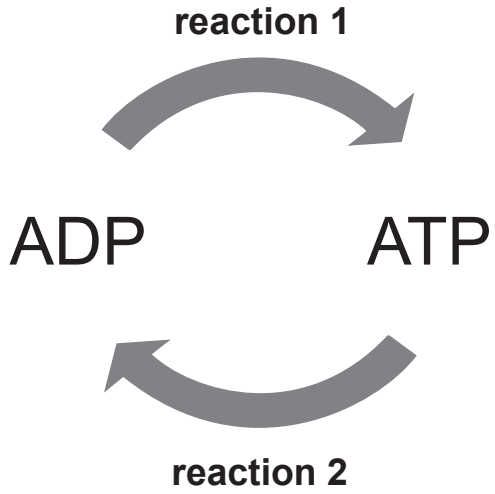
_____

_____

_____

_____ (4 marks)

30. *Refer to the following schematic diagram:*



(a) (i) Name a cellular process that provides energy for **reaction 1**, and describe the role of this energy in **reaction 1**.

Cellular process: _____

Role of energy: _____

_____

_____

_____ (4 marks)

(ii) Describe **reaction 2** and explain its importance for cells.

Description: _____

_____

_____

Explanation: _____

_____

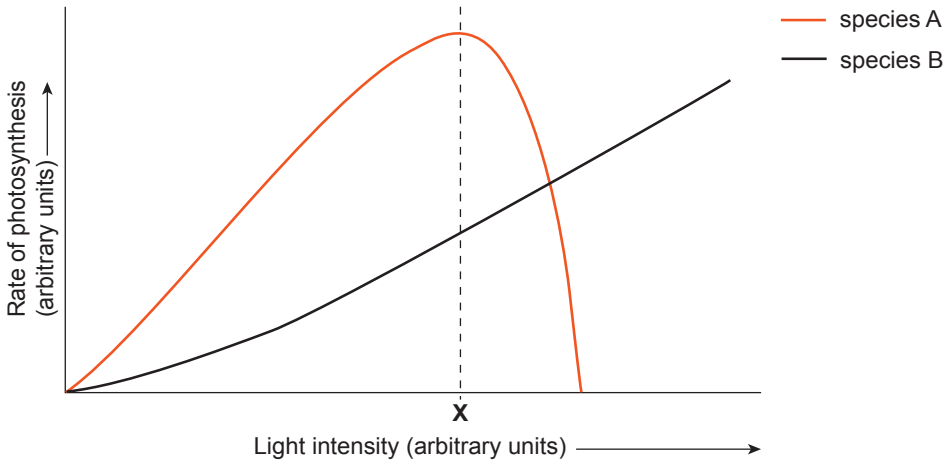
_____ (4 marks)

(b) State the type of energy lost at each step of a metabolic pathway.

_____ (2 marks)

31. *Refer to the following graph, which shows the results of an experiment to determine the effect of light intensity on the rate of photosynthesis in two species of plant:*

Rate of photosynthesis in two species of plant



(a) State a hypothesis that this experiment could be testing.

_____

_____ (2 marks)

(b) State the dependent variable in this experiment.

_____ (2 marks)

(c) Write a conclusion about the optimum light intensity for photosynthesis in each species of plant.

_____

_____

_____

_____

_____ (4 marks)

(d) Explain one reason for the different trends in the rate of photosynthesis in species A and species B at light intensities greater than **X**.

_____

_____

_____

_____

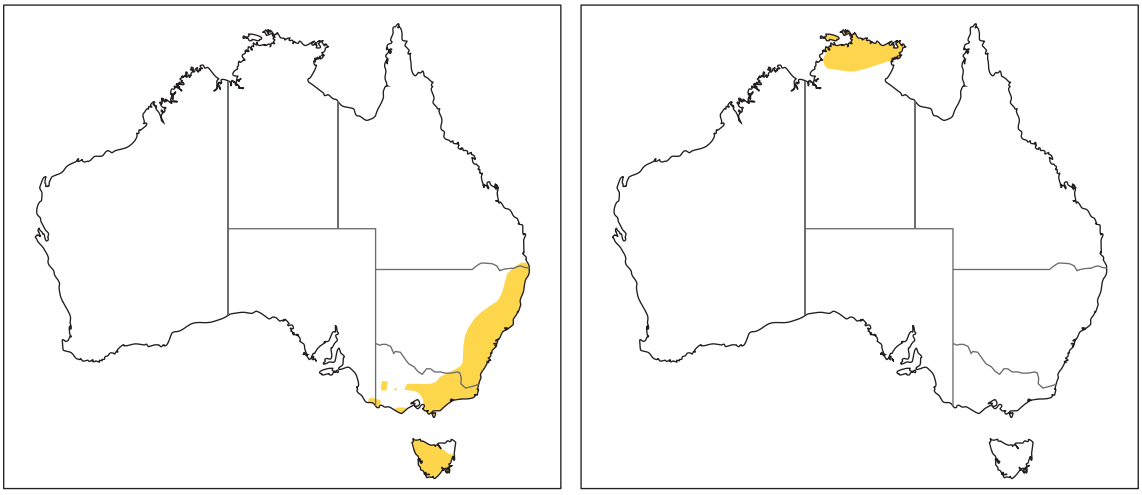
_____ (4 marks)

32. An antechinus is a small marsupial, native to Australia. It looks like a mouse, but it has quite different behaviour, including different reproductive habits.

Several species of antechinus are listed as endangered. These species are found throughout Australia and share many behavioural characteristics.

Source: Not Exactly Rocket Science, National Geographic, © Alan Couch, viewed 20 June 2016, phenomena.nationalgeographic.com

*Refer to the following maps, which show the distribution of the Dusky antechinus (*A. swainsonii*) and the Fawn antechinus (*A. bellus*):*



Dusky antechinus **Fawn antechinus**

Source: Based on data from Dickman et al. 2008 (Dusky antechinus) and Watson and Calaby 2008 (Fawn antechinus) presented as maps in The IUCN Red List of Threatened Species 2008, viewed 14 July 2016, maps.iucnredlist.org

The male antechinus lives for almost a year.

Females breed once and produce up to 14 offspring. They usually live a further 2 to 3 months, and raise their young during this time.

(a) From the information provided, state one reproductive strategy of the antechinus that is more *r*-selected and one that is more *K*-selected.

r-selected strategy: _____

_____

K-selected strategy:_____

_____ (4 marks)

(b) Describe how two different species of antechinus could have evolved from a single ancestral species.

_____

_____

_____

_____

_____ (4 marks)

(c) Explain how the extinction of one species affects other species.

_____

_____

_____

_____

_____ (4 marks)

33. Dung beetles (family Scarabaeidae) are arthropods that feed exclusively on animal faeces.

A recent survey identified almost 500 species of dung beetle that are native to Australia.

Some species were identified only because their DNA sequence was distinctly different from that of other beetles that they closely resembled.

Source: © Neal Cooper | Dreamstime.com

(a) Name one method that is used to multiply the DNA in a very small sample.

_____ (2 marks)

(b) Explain why it is important to have species such as dung beetles that eat animal faeces.

_____

_____

_____

_____

_____ (4 marks)

(c) Explain how maintaining biodiversity may be an advantage to human beings.

_____

_____

_____

_____

_____ (4 marks)

You may write on this page if you need more space to finish your answers to any questions in Part 2 of Section B. Make sure to label each answer carefully (e.g. 31(c) continued).

Government of South Australia

SACE Board of SA

External Examination 2016

2016 BIOLOGY

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QUESTION BOOKLET

3

8 pages, 2 questions

Monday 14 November: 9 am

Section C: Extended-response Questions

Write your answers to Section C in this question booklet.

3

SACE
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SECTION C: EXTENDED-RESPONSE QUESTIONS (Questions 34 and 35)

(30 marks)

*Answer **both** questions in this section.*

Write your answers in this question booklet:

- Question 34, on pages 4 and 5, is worth 15 marks.
- Question 35, on pages 6 and 7, is worth 15 marks.

You should spend about 30 minutes on this section, 5 to 10 minutes planning and 20 to 25 minutes writing.

Credit will be given for clear, well-expressed answers that are well organised and relevant to the questions.

34. Scientists use a number of different techniques to study and analyse DNA, including the artificial replication of DNA for forensic analysis. When using such techniques, every effort is made to minimise the effect of errors on the results.

- Describe the structure of a DNA molecule.
- Describe the mechanism of semi-conservative DNA replication that occurs naturally in a cell.
- Discuss the effects of random errors and systematic errors on the results of an experiment.

(15 marks)

35. In human beings, a decrease in blood pressure leads to the production of the hormones angiotensin II and aldosterone.

In the kidneys, angiotensin II causes contraction of the muscular walls of small arteries (vasoconstriction) and aldosterone causes an increase in the reabsorption of sodium ions and water in the nephrons.

The effect of these hormones is an increase in blood pressure.

- Describe the structural features of the nephron that increase the efficiency of reabsorption of sodium ions and water.
- Explain why communication via hormones is more effective than communication via nerves for the regulation of some physiological factors.
- State the effect of an increase in blood pressure on the production of the hormones angiotensin II and aldosterone, and explain how this helps to regulate blood pressure.

(15 marks)

You may write on this page if you need more space to finish your answers to Questions 34 and 35. Make sure to label each answer carefully (e.g. 34 continued).