

2
SECTION A

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

Answer all the questions.

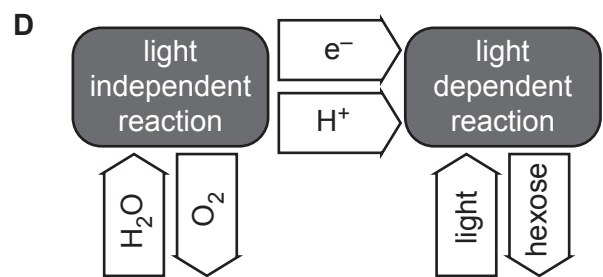
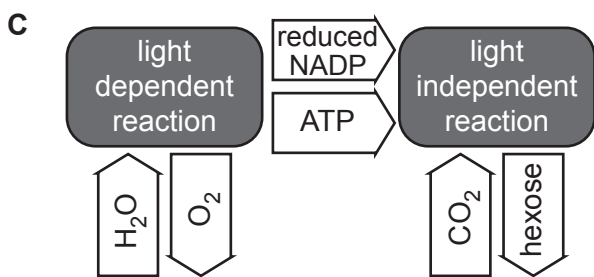
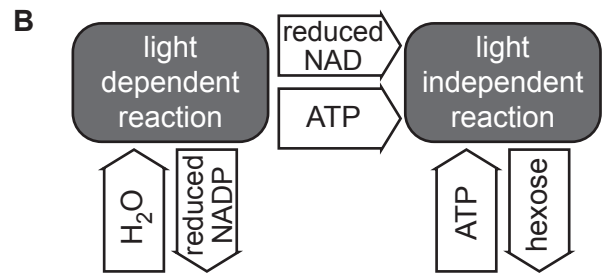
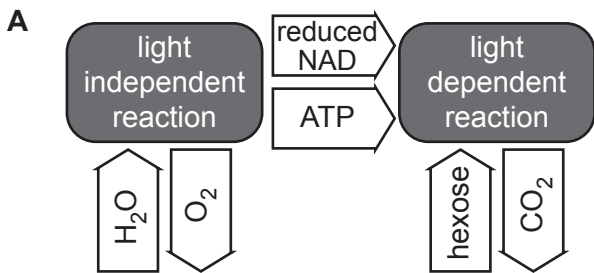
1 Which of the options, **A** to **D**, correctly describes how an endotherm would respond to an increase in temperature?

- A dilation of arterioles near the surface of the skin
- B erector muscles contract, causing hairs to stand up
- C rapid contractions of skeletal muscles
- D sweat glands release less sweat

Your answer

[1]

2 Which of the images, **A** to **D**, correctly summarises photosynthesis?

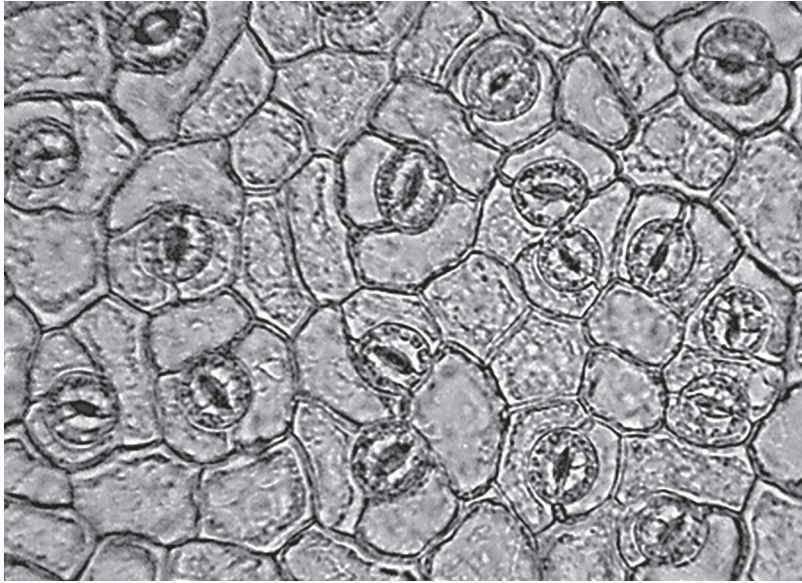


Your answer

[1]

- 3 A student counted stomata on a leaf using a light microscope. The image below shows the stomata that were visible.

The image magnification is $\times 60$.



Which of the options, **A** to **D**, is the correct stomatal density of this leaf?

- A 7.50 stomata mm^{-2}
- B 0.13 stomata mm^{-2}
- C 2428 stomata mm^{-2}
- D 0.21 stomata mm^{-2}

Your answer

[1]

- 4 Which of the options, **A** to **D**, occurs in the nucleus of a cell?

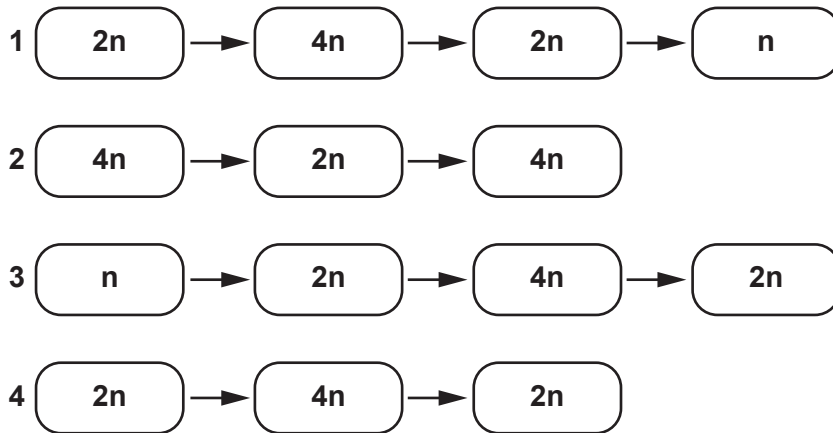
- A synthesis of enzymes
- B synthesis of RNA
- C modification of polypeptides
- D synthesis of carbohydrates

Your answer

[1]

5 During cell division, the chromosome number in the cells changes.

The following sequences describe the chromosome number in cells before, during and after different types of cell division.



Which of the options, **A** to **D**, correctly describes the stages of mitosis and meiosis in human cells?

- A** 1 is mitosis, 2 is meiosis
- B** 2 is mitosis, 3 is meiosis
- C** 3 is mitosis, 4 is meiosis
- D** 4 is mitosis, 1 is meiosis

Your answer

[1]

6 Patients with kidney failure can be treated in different ways.

Which of the following statements describes a feature of peritoneal dialysis?

- 1 Urea and mineral ions pass into the tissue fluid.
- 2 Blood is passed over an artificial membrane to remove toxins.
- 3 The patient receives immunosuppressant medication.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

- 7 Bony fish absorb dissolved oxygen from the water using gills. Water is passed through the buccal cavity and over the gill lamellae. The oxygen saturation of the blood and water changes as the water passes over the gills.

Which of the statements, **A** to **D**, correctly describes the way oxygen is transferred into the blood at the gills?

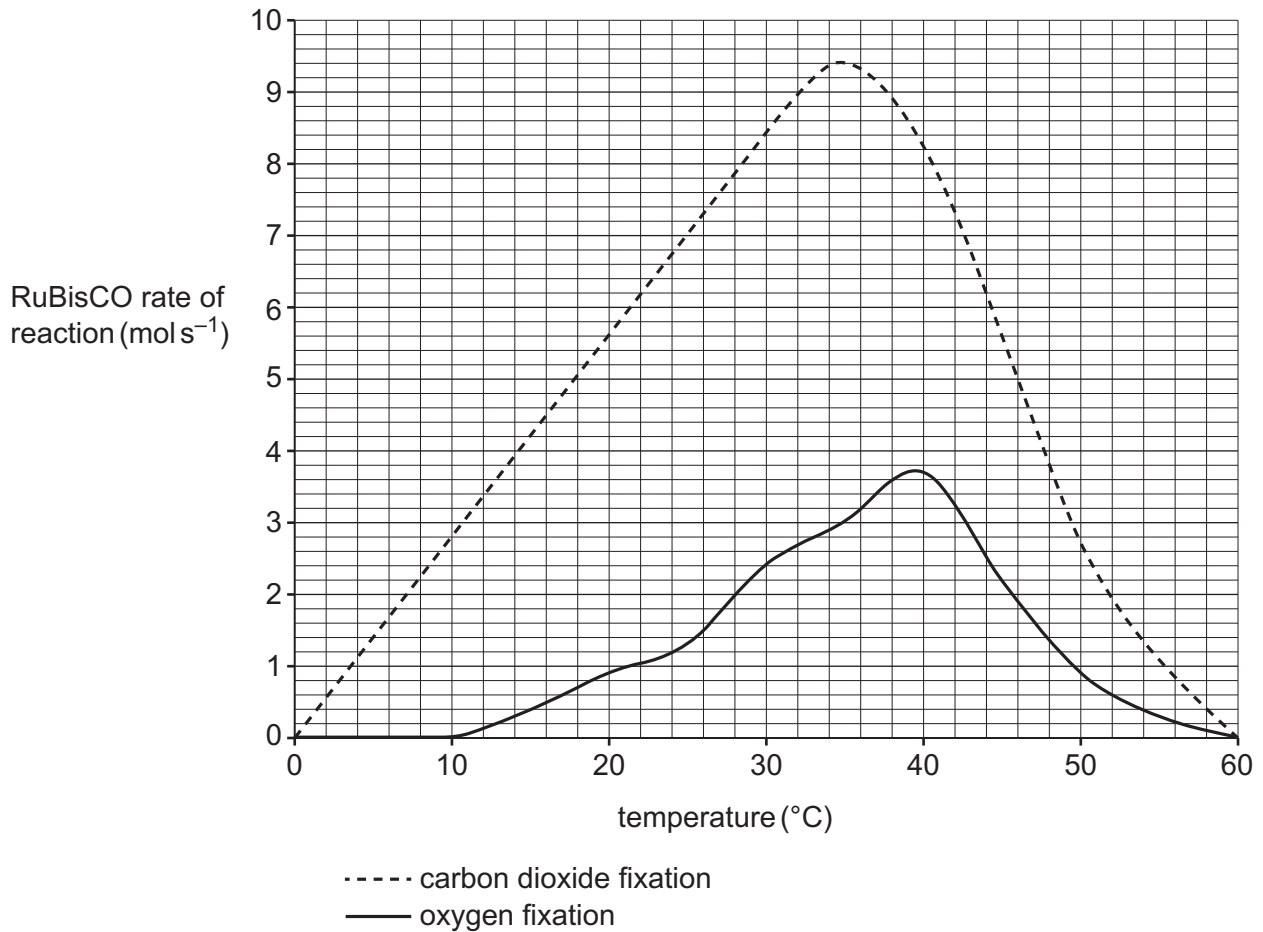
- A** Blood and water flow in a concurrent system with a constant concentration gradient between them.
- B** Blood and water flow in a countercurrent system with a constant concentration gradient between them.
- C** Blood and water flow in a concurrent system with a greater concentration gradient between them at the start of the gill lamella.
- D** Blood and water flow in a countercurrent system with a greater concentration gradient between them at the start of the gill lamella.

Your answer

[1]

- 8 RuBisCO is an enzyme that fixes carbon dioxide in photosynthesis. In some conditions, RuBisCO also carries out oxygen fixation.

The graph below shows how the carbon dioxide and oxygen fixing activities of RuBisCO are affected by temperature.



What are the correct percentage changes in RuBisCO carbon dioxide and oxygen fixing activities between 30 °C and 40 °C?

- A** carbon dioxide fixation –12.7%, oxygen fixation 23.3%
- B** carbon dioxide fixation –14.6%, oxygen fixation 18.9%
- C** carbon dioxide fixation –2.4%, oxygen fixation 54.2%
- D** carbon dioxide fixation –3.6%, oxygen fixation 35.1%

Your answer

[1]

- 9 The hormone hCG can be detected in urine using pregnancy tests.

Which of the following properties of the hormone hCG allows it to be detected in urine?

- A hCG is a polar molecule
- B hCG has a molecular mass of less than 69,000
- C hCG is a polypeptide
- D hCG binds to cells using glycoproteins

Your answer

[1]

- 10 The hormone ecdysone is synthesised in the prothoracic glands found in the upper thorax of some invertebrates and is released into haemolymph. It is then transported to cells near the surface of the body and causes the loss of the exoskeleton so that a new exoskeleton can form.

Which of the following statements explains how ecdysone is able to act on cells near the surface of the body?

- 1 Ecdysone is synthesised by specialised neurosecretory cells.
- 2 Ecdysone is soluble in haemolymph because it is a polar molecule.
- 3 Ecdysone is complementary to cell surface receptors on cells throughout the body of some invertebrates.

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

Your answer

[1]

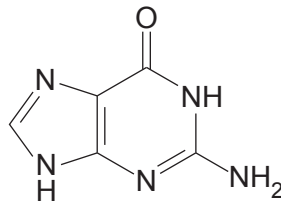
11 Which of the statements, **A** to **D**, correctly describes the process of adhesion?

- A** attraction of water molecules to the impermeable walls of xylem tissue
- B** attraction of water molecules to other water molecules in the xylem tissue
- C** active transport of water molecules into phloem tissue
- D** attraction of water molecules to other water molecules in the phloem tissue

Your answer

[1]

12 The image below shows the structure of the nucleotide base guanine.



Bird droppings are known as *guano* because they contain a high proportion of guanine. Unlike mammals, birds excrete nitrogenous waste as guanine instead of urea. Guanine is synthesised from ammonia in the liver.

The following statements relate to guanine:

- 1 ammonia is more toxic than guanine
- 2 urea is more soluble in water than guanine
- 3 guanine has a high proportion of nitrogen

Which of the statements correctly explains why birds excrete guanine?

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

13 Different sized mammals have different surface area to volume ratios.

The table shows the surface areas and volumes of four different groups of mammals.

Mammal genus	Surface area (m ²)	Volume (m ³)
<i>Oryctolagus</i>	0.48	2.0×10^{-2}
<i>Equus</i>	18.26	2.24
<i>Mus</i>	1.9×10^{-3}	7.2×10^{-5}
<i>Rattus</i>	0.32	1.6×10^{-2}

Which of the options, **A** to **D**, is the correct order of surface area to volume ratios for the different mammals, arranged from the largest to the smallest?

- A *Oryctolagus, Rattus, Equus, Mus*
- B *Mus, Rattus, Oryctolagus, Equus*
- C *Mus, Oryctolagus, Rattus, Equus*
- D *Equus, Mus, Oryctolagus, Rattus*

Your answer

[1]

- 14 The commercially grown tobacco plant, *Nicotiana rustica*, has many pests. One such insect pest is *Manduca sexta*, which causes damage to the stems and leaves of *N. rustica*.

The tiny wasp *Cotesia congregata* lays its eggs inside the body of *M. sexta*. When the larvae develop they feed on the body of the host, eventually killing it.

N. rustica produces a volatile organic compound called volicitin when its leaves are damaged.

Volicitin attracts *C. congregata* at high concentrations.

Which of the following explains why *N. rustica* releases volicitin?

- 1 volicitin release reduces herbivory in *N. rustica*
- 2 volicitin release increases *M. sexta* growth rate
- 3 volicitin release reduces parasitism of *M. sexta* by *C. congregata*

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

Your answer

[1]

- 15 Mistletoe is a plant parasite that lives on the stems of other plants. It survives by removing water and assimilates from the host plant.

The mistletoe binds to the stem of the host plant and grows a specialised root-like tissue called a haustorium that attaches to different tissues in the stem.

One species of mistletoe, *Viscum minimum*, contains no chloroplasts.

Which of the options, **A** to **D**, explains why *V. minimum* does not need chloroplasts?

- A** the haustorium of *V. minimum* attaches to sieve tube elements
- B** the haustorium of *V. minimum* attaches to xylem vessels
- C** the haustorium of *V. minimum* attaches to meristem cells
- D** the haustorium of *V. minimum* attaches to cambium tissue

Your answer

[1]

SECTION B

Answer **all** the questions.

- 16 (a)** Many insects such as moths and bumblebees are insulated with scales and hair, and are known as facultative endotherms.

Their metabolism during flight can cause the temperature of the flight muscles to increase 20–30 °C above the external temperature.

- (i)** Using the information provided, explain why many moths and bumblebees are described as endothermic.

.....
.....
..... [1]

- (ii)** It is more difficult for moths and bumblebees to maintain their body temperature than for mammals and birds to maintain their body temperature.

Explain why.

.....
.....
.....
.....
..... [2]

- (b) When walking, the abdomen of caterpillars expands and contracts slowly. Air is taken into the tiny holes along the side of the body.

One of these holes is labelled in Fig. 16.

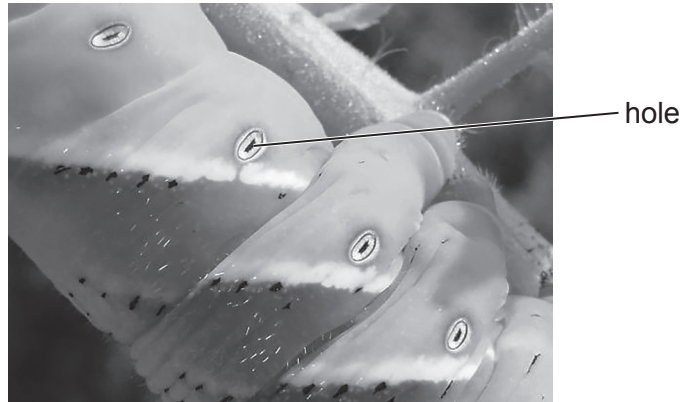


Fig. 16

- (i) Name these holes.

..... [1]

- (ii) Fluid is found in the tubes responsible for gaseous exchange in insects.

Name this fluid.

..... [1]

- (c) Outline the reasons why insects and other animals need well-developed transport systems.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [3]

(d) A student planned to carry out a dissection of insect and fish gaseous exchange systems.

The student planned to complete diagrams of the different tissues. They were advised to observe the following guidelines:

- use a sharp pencil
- use ruled label lines
- include a scale bar.

Suggest **two** further guidelines for the student to follow to ensure they present their diagrams clearly and accurately.

1

.....

.....

.....

2

.....

.....

..... [2]

Question	Answer	Marks	Guidance
1	A ✓	1	
2	C ✓	1	
3	A ✓	1	
4	B ✓	1	
5	D ✓	1	
6	D ✓	1	
7	B ✓	1	
8	C ✓	1	
9	B ✓	1	
10	C ✓	1	
11	A ✓	1	
12	A ✓	1	
13	C ✓	1	
14	D ✓	1	
15	A ✓	1	
		Total	15

Question			Answer	Marks	Guidance
16	(a)	(i)	scales and hair help to reduce heat loss ✓ generate heat from , respiration / metabolism ✓	1max	ALLOW generate heat internally IGNORE temperature
	(a)	(ii)	(insects are smaller and) have a , large(r) / AW , surface area to volume ratio ✓ (insects have) <u>greater</u> rate of heat loss ✓ mammals and birds have , more effective / <u>thicker</u> , insulation ✓ <i>ref to a method</i> of more precise control of body temperature in birds and mammals ✓	2 max	Mps 1 and 2 ALLOW ora for mammals (must be comparative) ALLOW SA:V / surface area relative to volume ALLOW lose heat more , quickly / easily ALLOW have fat under skin ALLOW ora for insects (must be comparative) e.g. thermoregulatory centre / heat gain / heat loss centre e.g. vasodilation / vasoconstriction e.g. sweating / shivering / hairs standing up
16	(b)	(i)	spiracle (s) ✓	1	ALLOW stigma(ta) DO NOT ALLOW stomata
	(b)	(ii)	<u>trachea(l)</u> (fluid) ✓	1	IGNORE haemolymph IGNORE tracheole

Question		Answer	Marks	Guidance
16	(c)	<p>high metabolic , demands / rate ✓</p> <p>need , large oxygen / rapid oxygen , supply ✓</p> <p><u>diffusion</u> , not sufficient / too slow / distance too far ✓</p> <p>(to) <u>maintain</u> , steep / AW , concentration / diffusion , gradient(s) ✓</p> <p>surface area to volume ratio is (usually) low ✓</p> <p>(named) metabolite(s) needed by <u>cells</u> / (named) waste(s) removed from <u>cells</u> ✓</p>	3 max	<p><i>give credit to examples used in the correct context</i></p> <p>ALLOW high rate of respiration</p> <p>IGNORE not efficient</p> <p>ALLOW SA:V / surface area relative to volume</p> <p>ALLOW nutrients / hormones</p> <p>IGNORE oxygen</p> <p>ALLOW toxins</p>

Question		Answer	Marks	Guidance
16	(d)	<p>1 large size / at least 50% of available space ✓</p> <p>2 title / heading ✓</p> <p>3 labels outside diagram ✓</p> <p>4 label lines should not cross over others ✓</p> <p>5 continuous lines ✓</p> <p>6 no shading ✓</p> <p>7 use plain paper ✓</p> <p>8 state magnification ✓</p> <p>9 correct proportions ✓</p>	2 max	<p>IGNORE numbered lines and mark as prose</p> <p>IGNORE references to detail of diagram</p> <p>ALLOW once only no , sketching / feathering for either mp5 or mp6</p>
		Total	10	