

Answers

Chapter 1 Cell structure

Exercise 1A Cell ultrastructure and functions

- 1 C
- 2 Nucleus
- 3 Selectively permeable
- 4 Ribosomes
- 5 Aerobic respiration

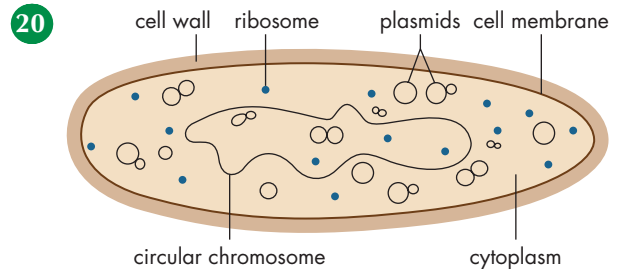
Hint Remember to give full description and not just 'respiration'.

- 6 Sperm / nerve cell
Have a high energy demand associated with their function of swimming/transmission of nerve impulses
- 7 Cytoplasm
- 8 B
- 9 Ribosomes
- 10 D
- 11 To trap sunlight energy/organelle where photosynthesis takes place
- 12 a X: vacuole
Y: cytoplasm
b Controls all the cell's activities
c Chloroplasts
Potato grows underground so light does not penetrate and therefore there is no requirement for chloroplasts
- 13 Yeast
- 14 Fungal cell has nucleus, bacterial cell has no definite nucleus / fungal cell has mitochondria, bacterial cell has no mitochondria / fungal cell wall is different from bacterial cell wall

Hint When asked to contrast two different features, structures, functions etc, don't just say, for example, 'a fungal cell has a nucleus' but add the contrasting statement 'a bacterial cell has no definite nucleus'.

- 15 D
- 16 1 Cytoplasm
2 Ribosome
3 Mitochondrion
4 Nucleus
5 Cell wall
6 Cell membrane
- 17 Stores genetic material
- 18 Both contain cell membrane / cytoplasm / cell wall

19 C



- 21 A
- 22 Both contain cytoplasm / cell membrane / cytoplasm / mitochondria / nucleus / ribosomes
- 23 a B
b B
c Line drawn to hit cell wall present in one of the plant cells
- 24 a Has chloroplast, which is found in green plant cell
b Has no cell wall, which is absent in an animal cell

- c Nucleus and cell membrane
- d Cytoplasm / ribosomes / mitochondria

25 D

26 a D

b D

c A

27

Description	True	False	Correction
Bacteria lack a <u>nucleus</u> .	✓		
Chloroplasts are found in <u>plant</u> cells.	✓		
Ribosomes are found in <u>some</u> cells.		✓	all

Exercise 1B Cell wall

1 A

2 Cellulose

3 a B

b A

4 The walls of both bacterial and plant cells are [different]

5 Bacterial cell has a cell wall, cheek-lining cell does not

Exercise 1C Key terms

1 L

2 B

3 D

4 I

5 A

6 H

7 J

8 F

9 G

10 C

11 E

12 K

13 Q

14 P

15 M

16 O

17 N

Exercise 1D Skills of scientific inquiry

1 a $\times 5$

b $\times 5$

2 $2.5 / 1000 = 0.0025 \text{ mm}$

3 a

Type of cell	Average size (mm)	Average size (μm)
Fungal	0.008	8
Animal	0.025	25
Plant	0.050	50
Bacterial	0.004	4

b 1:2 [order important]

c Two times

4 a 1.6 mm

b 0.75 mm

5 a 10:5:1 [order important]

b B

c 92.6 %

d F in cat

Chapter 2 Transport across cell membranes

Exercise 2A Cell membrane

1 A Proteins

B Double layer of phospholipids

2 Regulates/controls what can enter or leave a cell

Exercise 2B Passive transport – osmosis and diffusion

- 1 Water, oxygen, carbon dioxide
- 2 B
- 3 [down] [do not]
- 4 passive; high concentration; low concentration
- 5 a Level on the left will fall and level on the right will rise
b Osmosis
- 6 a Red blood cell will burst / as water moves from an area of high water concentration to an area of low water concentration / down the concentration gradient
b Red blood cell will shrink / as water moves from an area of low water concentration to an area of high water concentration / down the concentration gradient / across a selectively permeable membrane
- 7 D
- 8 B
- 9 a X: carbon dioxide Y: oxygen
b Diffusion
c Carbon dioxide moves out of the blood stream / from an area of high to low concentration down the concentration gradient
Oxygen moves into the blood stream / from an area of high to low concentration down the concentration gradient
- 10 1 A Cell has become turgid / due to water moving in from a region of high to low water concentration / down the water concentration gradient
2 C Cell has become plasmolysed / due to water travelling out from a region of high to low water concentration / down the concentration gradient
3 B There is no net change in the cell / since the water concentration outside and inside are the same / there is no concentration gradient

- 11 a There would be a loss in mass
There is a high water concentration (HWC) inside the carrot and a low water concentration (LWC) outside
Water moves from a HWC to a LWC thus reducing the mass of the carrot
b Dried to remove any water on the outside of the carrot
c Repeat the experiment / use many pieces of carrot
- 12 a Osmosis
b To expose the potato cells to the surrounding water
c The rate of change would have been slower
The difference in concentration outside and inside the potato tissue would not have been so great
d Use boiled potato

Exercise 2C Active transport

- 1 Movement of molecules / ions against the concentration gradient
- 2 Active transport moves molecules / ions against the concentration gradient while diffusion moves them in the opposite direction
Active transport requires energy while diffusion is a passive process
Active transport requires protein carriers while diffusion does not
- 3 Uptake of glucose in the kidneys / movement of sodium and potassium ions in nerve cells
Uptake of iodine from sea water by some seaweeds / uptake of ions from soil by root hair cells
- 4 C
- 5 a A: Diffusion B: Active transport
b A

6	Description	True	False	Correction
	Active transport <u>does not</u> require energy		✓	does
	Active transport moves ions from a <u>high to low</u> concentration		✓	low to high
	Diffusion works in the <u>same</u> direction as active transport		✓	opposite

Exercise 2D Key terms

- 1 G
- 2 I
- 3 A
- 4 H
- 5 C
- 6 E
- 7 D
- 8 F
- 9 B

Exercise 2E Skills of scientific inquiry

- 1 a Concentration of the salt solution
- b Temperature / same courgette used for all discs / identical method of measuring diameter for all discs
- c 5
Disc diameter reduced due to movement of water from inside to outside / down the water concentration gradient
- d 1
- e To show the effect of 0 % salt / pure water
- f Only six discs were used / the experiment was run only once / no intermediate salt concentrations were used

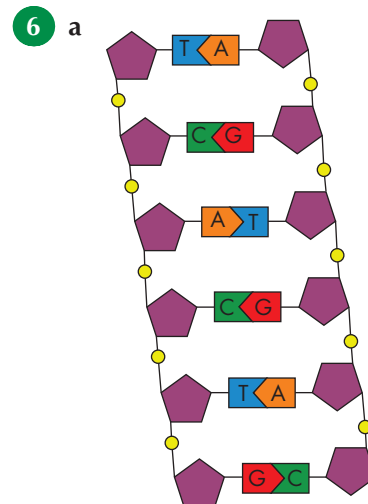
g D

h Placed discs on 1 mm graph paper to measure diameter

Chapter 3 DNA and the production of proteins

Exercise 3A DNA structure and function

- 1 B
- 2 helix / complementary / bases / proteins / thymine / code / Messenger
- 3 Row 1: false / nucleus ; row 2: true
- 4 B
- 5 a Adenine
- b Two
- c Sequence / order of the bases



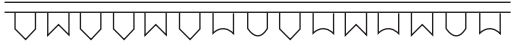
A opposite all Ts and G opposite all Cs

Phosphate group correctly identified as small yellow circle on graphic, deoxyribose molecule is purple pentagon

b Helical shape

- 7 B
- 8 DNA / bases / amino acids / protein

Exercise 3B Protein synthesis

- 1 Row 1: false / nucleus; row 2: true
- 2 a A D C
b 
- 3 a AGACGCACAAGA
b TCTGCGTGTCT
- 4 B
- 5 a D C B A
b Sequence of amino acids
- 6 a Complementary
b DNA has helical shape
c Nucleus
d Into cytoplasm
e Ribosome

Exercise 3C Key terms

- 1 B
- 2 F
- 3 H
- 4 E
- 5 D
- 6 C
- 7 A
- 8 G
- 9 O
- 10 K
- 11 L
- 12 I
- 13 M
- 14 J
- 15 N

Exercise 3D Skills of scientific inquiry

1 32 %

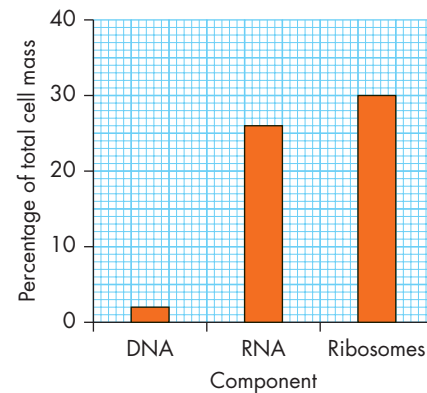
2 a

Base	Number of bases	Percentage of bases
C	150	30
G	150	30
T	100	20
A	100	20

b 2:3 [order important]

c Cytosine 200; guanine 200; thymine 300; adenine 300

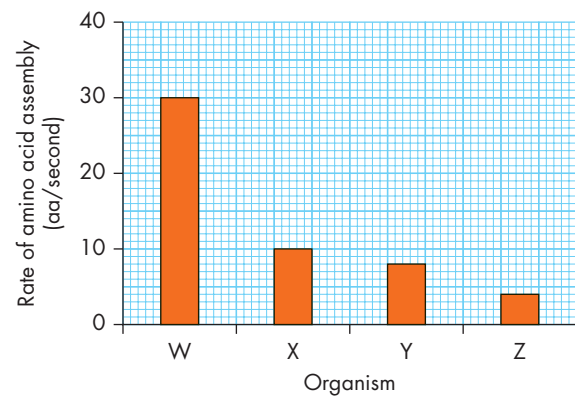
3 a



b 13:1 [order important]

4 600

5 a



b 13 aa/second [units essential]

c X

Chapter 4 Proteins

Exercise 4A Protein structure and function

- 1 functions / amino acids
- 2 Structure / enzyme / hormone / antibody / receptor
- 3 B
- 4 B
- 5 D
- 6 A

Exercise 4B Enzymes

- 1 a key is enzyme / lock is substrate
 - b A: substrate
 - B: active site
 - C: enzyme-substrate complex
- 2 They speed up biochemical reactions
They are unchanged by the reaction they catalyse
They are made up of proteins
- 3 Each enzyme is specific to a substrate
Stains will often have different components / substrates
More than one enzyme is needed for each component / substrate
- 4 Enzymes act on only one substrate
- 5 D
- 6 C
- 7 D
- 8 [unchanged]
- 9 [A]: 2 [B]: 3
- 10 A
- 11 a glucose-1-phosphate
 - b Starch
 - c C

- 12 a As the temperature increases from 20°C to 48°C, the enzyme activity increases; until, above 40°C, the activity falls rapidly

Hint Always use the data. Don't just say 'As the temperature increases the enzyme activity increases'.

- b Optimum
- c Denaturation
- d No starch would have been broken down
- e pH / concentration of substrate / concentration of enzyme
- 13 a Amylase breaking down starch [substrate] into maltose/sugar [product]
- b Potato phosphorylase synthesising starch [product] from glucose-1-phosphate [substrate]
- c Protein
- 14 a As the substrate concentration increases, the activity of the enzyme increases until a concentration increase at point X no longer causes any increase in activity
- b pH and temperature

15 Statement	True	False	Correction
Enzymes are made up of a chain of <u>amino acids</u>	✓		
Reactions in a cell go much <u>faster</u> in the presence of suitable enzymes	✓		
At very low temperatures enzymes are <u>denatured</u>		✓	inactive

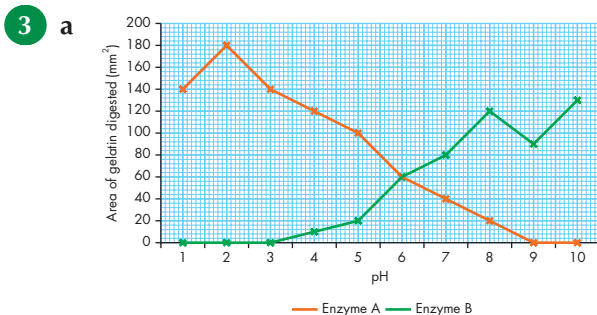
Exercise 4C Key terms

- 1 B
- 2 E
- 3 A

- 4 C
- 5 D
- 6 H
- 7 F
- 8 G
- 9 K
- 10 L
- 11 J
- 12 I

Exercise 4D Skills of scientific inquiry

- 1 50 %
- 2 a Nine
- b Phe and Thr
- c 2: 2: 3 [order important]
- d 10 %



- b 6
- c Activity of enzyme B at pH 9
Error in measurement
- d Repeat the investigation / use more intermediate values of pH
- e A
Active at low pHs
- 4 a As pH rises from 5 to 9, the activity of the enzyme increases
After 9, the activity falls rapidly

- b 4.5
- c A: 2 B: 7 C: 9
- d 11

Chapter 5 Genetic engineering

Exercise 5A Genetic engineering

- 1 information / transferred / engineering
- 2 a A1 / B4 / C2 / D6 / E7 / F3 / G5
- b Enzymes
- c No allergic / rejection reactions; no animals involved; dependable source; exactly the same as human insulin in its structure and function
- d People live longer; world population increasing; some lifestyles increase the chances of developing diabetes
- e Human growth hormone; factor VIII; antibiotics

- 3 D
- 4 plasmid; circular; copies; chromosome; plasmid; foreign; quickly; lab; copies; protein; large

5 D E F B A C

- 6 a C
- b C

7 C

8 D

- 9 a 1: A
- 2: F
- 3: C
- 4: D
- 5: E
- 6: B

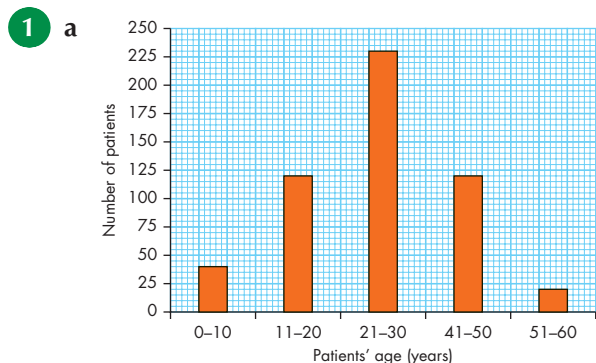
- b Appeal to vegans and vegetarians / predictable / fast / relatively cheap

10	Description	True	False	Correction
	Bacteria have a large <u>circular</u> chromosome.	✓		
	Genetic engineering is the transfer of <u>whole chromosomes</u> from one species to a different species		✓	gene(s)
	<u>Plasmids</u> can be used in genetic engineering to carry genes	✓		

Exercise 5B Key terms

- 1 D
- 2 A
- 3 B
- 4 C
- 5 F
- 6 E
- 7 H
- 8 I
- 9 G

Exercise 5C Skills of scientific inquiry



- b Number of patients taking genetically modified insulin increases dramatically after 10 years

Reaching a peak within the range 21–30 years

After which, the number falls quickly

c $\frac{(230 - 20)}{230} \times 100 = 91 \%$

- d 4:23:12 [order important]

e $\frac{(20 - 18)}{20} \times 100 = 10 \%$

- 2 a The people who thought the harmful results of genetic engineering outweigh benefits were consistently less every year compared with the other two groups

The general trend from 1985–1995 was an increase from 12.5 % to 22 %

This stabilised from 1995–1997 at 22 %

After this it fell from 1997 at 22 % to 1999 at 18 % then rose again reaching its highest level of 28 % in 2001

Hint Whichever example you choose, make sure you give sufficient detail as shown here, using actual numbers.

- b Those people who thought the harmful results of genetic engineering outweigh benefits

- c 1999–2001

Those people who thought the harmful results of genetic engineering outweigh benefits

Chapter 6 Respiration

Exercise 6A Stored chemical energy

- 1 chemical; glucose; cells; enzymes; respiration

Exercise 6B ATP

- 1 a contraction
 b division
 c transmission
 d protein synthesis

2 D

3 C

Exercise 6C Respiration and fermentation

1 A

2 4 3 2 5 1

3	Aerobic respiration	Fermentation
	A	B
	D	C
	E	

4 D

5 A

6 D

7 A

8 a energy source / acts as a substrate

b remove any dissolved oxygen / kill any other organisms that might be present

c stops any atmospheric oxygen diffusing into glucose solution

d carbon dioxide

e some energy produced during respiration is lost as heat

f repeat the experiment

g to prove what is causing the change / to allow comparison with the live yeast

9 C

10 a X carbon dioxide Y water

b stage A: cytoplasm

stage B: mitochondrion

11

Description	True	False	Correction
<u>Protein</u> is the most common source of energy in cells.		✓	glucose
ATP acts as a <u>link</u> between energy-releasing reactions and those reactions that require energy.	✓		
The first stage of aerobic respiration takes place in the <u>mitochondrion</u> .		✓	cytoplasm
Fermentation results in 2 ATP being released from the breakdown of glucose in the <u>presence</u> of oxygen.		✓	absence

Exercise 6D Key terms

1 C

2 A

3 D

4 E

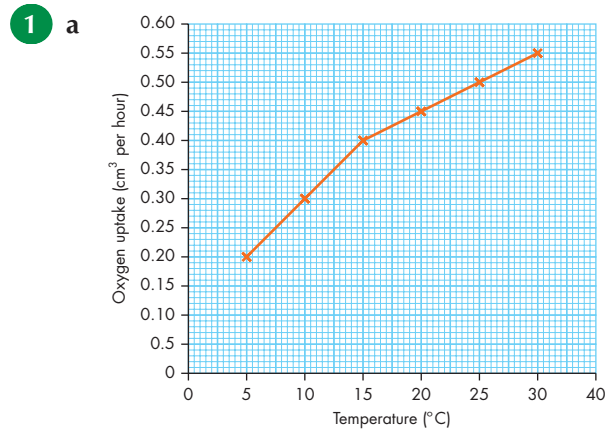
5 G

6 H

7 F

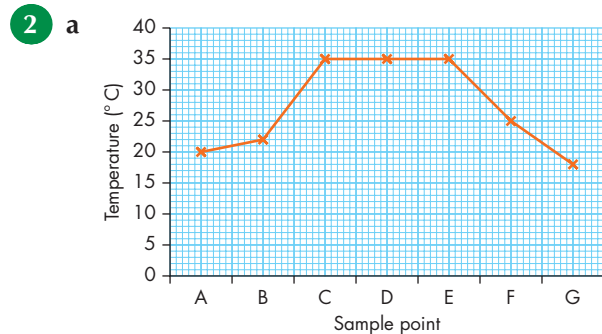
8 B

Exercise 6E Skills of scientific inquiry



Hint Don't plot zero values unless you have been given these

- b** As the temperature increases, the uptake of oxygen increases
- c** Act as a control
- d** Acts as a platform to support / prevent chemicals from coming into contact with the live maggots
- e** Use more intermediate temperatures / ensure masses of chemical and cotton wool are identical in both tubes
- f** 0.60 cm³ per hour



- b** From sample point A through to sample point E, the temperature increases from 20°C to 35°C
After sample point E the temperature falls to 18°C

Hint Make sure you use the actual data.

- c** Sample point D
Likely to have the lowest oxygen concentration here in the middle of compost heap

Chapter 7 Producing new cells

Exercise 7A Mitosis

- 1 a** X: chromatid, Y: centromere, Z: spindle fibre
- b** Y: holds paired chromatids together, Z: pulls chromatids to opposite poles of the cell
- 2** C A D B
- 3 a** 1 3 2 4
- b** 2
- c** 1
- 4** Growth/repair/maintenance of chromosome complement
- 5** Two identical diploid daughter cells
- 6** D
- 7 a** C
- b** B
- c** D
- 8 a** Four
- b** Eight
- c** Four

Exercise 7B Stem cells

- 1** Unspecialised
- 2** Growth and repair of cells/tissues
- 3** They can divide by mitosis
- 4** Animals
- 5**

Description	True	False	Correction
Located in animals	✓		
Involved in growth and respiration		✓	stem cells are involved in growth and repair
Have the ability to self-renew	✓		
Are specialised cells		✓	
Have the potential to become one type of cell		✓	stem cells have the potential to become many types of cell

Exercise 7C Specialisation

- 1 The formation of a variety of cells, tissues and organs from an un specialised cell
- 2
 - a Groups of similar cells working together
 - b Groups of similar tissues working together
 - c Organs working together
- 3 Cells → tissues → organs → organ systems → organism
- 4
 - a Red blood cell, sperm cell, skin cell or any other
 - b Muscle, skin, nervous, xylem, phloem or any other
 - c Heart, lungs, leaf, root or any other
 - d Circulatory, respiratory, digestive, nervous, skeletal, root or any other

5	Statement	True	False	Correction
	Spindle fibres pull <u>chromatids</u> apart to opposite poles of the cell.	✓		
	Mitosis provides new cells for growth and repair of damaged cells and maintains the <u>haploid</u> chromosome complement.		✓	diploid
	Stem cells in animals are <u>specialised</u> cells which can divide in order to self-renew.		✓	unspecialised
	Specialisation of cells leads to the formation of a variety of cells, <u>tissues</u> and organs.	✓		
	Groups of organs which work together form <u>organisms</u> .		✓	systems

Exercise 7D Skills of scientific inquiry

- 1
 - a As time increases from 0–30 hours, the number of colonies of cells increases from 0 to 7. Between 30–36 hours the number of colonies decreases from 7 to 6
 - b 1:4
 - c 300 %
 - d 0.16666 or 0.17
 - e 99

Exercise 7E Key terms

- 1 S
- 2 D
- 3 I
- 4 E
- 5 F
- 6 A
- 7 N
- 8 K
- 9 G
- 10 O
- 11 L
- 12 C
- 13 J
- 14 R
- 15 Q
- 16 X
- 17 V
- 18 H
- 19 T
- 20 B
- 21 M

22 W

23 U

24 P

Chapter 8 Control and communication

Exercise 8A nervous system and reflex arc

- 1 a Central nervous system (CNS) and nerves
b Brain and spinal cord
c Cerebrum, cerebellum, medulla
- 2 a Coordinates movement, including muscle contraction and balance
b Responsible for thoughts, intelligence, personality, memory, speech
c Controls heart rate and breathing
- 3 a CEREBRUM
b CEREBELLUM
c MEDULLA
- 4 C
- 5 Transmits electrical impulses
- 6 a Sensory, inter, motor
b Sensory: transmits impulse from receptor to CNS; inter: transmits impulse from sensory to motor via spinal cord; motor: transmits impulse from CNS to effector
- 7 Detects stimuli/sensory input
- 8 a Synapse
b Chemicals are released that diffuse across the synapse from one neuron to the receptors on the next neuron (carrying on the message from the electrical impulse)
- 9 A rapid automatic response to a stimulus
- 10 Receptor → sensory neuron → inter neuron (spinal cord) → motor neuron → effector (muscle/gland)
- 11 To protect the body from further damage by allowing it to react quickly to stimuli, like high temperatures, that may be harmful

12 V sensory neuron

W inter neuron

X motor neuron

Y receptor

Z effector

Exercise 8B Hormones and blood glucose regulation

- 1 Secrete hormones into the blood stream
- 2 a In the blood
b Act as chemical messengers
c A target tissue has cells with complementary receptor proteins for specific hormones, so only that tissue will be affected by these hormones
- 3 a Hormone secreted by the pancreas in response to higher blood glucose levels that targets receptors on the liver and instructs them to convert excess glucose into glycogen for storage
b Hormone secreted by the pancreas in response to lower blood glucose levels that targets receptors on the liver and instructs them to break down glycogen into glucose and release it into the blood
c Endocrine gland that detects blood glucose levels and responds to higher or lower levels by secreting either more insulin or glucagon
d Organ upon which the hormones insulin and glucagon act, causing it either to store glucose as glycogen or break down glycogen to glucose
e Storage of carbohydrate in the liver
- 4 a Pancreas detects lower blood glucose levels and secretes more glucagon, which binds to the liver's receptors and results in the breakdown of stored glycogen into glucose, which is released into the blood
b Pancreas detects higher blood glucose levels and secretes more insulin, which binds to the liver's receptors and results in the conversion of glucose to glycogen, which is stored in the liver

- c Pancreas detects lower blood glucose levels and secretes more glucagon, which binds to the liver's receptors and results in the breakdown of stored glycogen into glucose, which is released into the blood
- d Pancreas detects higher blood glucose levels and secretes more insulin, which binds to the liver's receptors and results in the conversion of glucose to glycogen, which is stored in the liver
- e Pancreas detects lower blood glucose levels and secretes more glucagon, which binds to the liver's receptors and results in the breakdown of stored glycogen into glucose, which is released into the blood

5 Pancreas

6 Glycogen, liver

7 pancreas	pancreas
glucagon	insulin
liver	liver
glycogen to glucose	glucose to glycogen

8 B

9 C

10 Row 1: false / brain; row 2: false / receptors; row 3: true; row 4: true; row 5: true

Exercise 8C Skills of scientific inquiry

- 1 a As time after consuming the glucose drink increases from 0 to 60 minutes, the blood glucose levels increase from 4.1 to 10.6 mmol/l, but as the time increases from 60 to 180 minutes, the blood glucose levels decrease from 10.6 to 4.8 mmol/l
- b 3:1
- c 100 %
- d 0.03 mmol/l
- e 12.8 mmol/l
- f As each person had different starting values, a valid comparison could not be made unless it was changed to a percentage increase

g Individual X because their glucose levels are higher than normal to start with, and insulin should lower glucose levels when they get higher than normal

h Volume/concentration of glucose drink / room temperature / activity levels

2 A control experiment should have all the same variables as the test experiment except the one being investigated. This proves that the variable being investigated is the one responsible for the results

Exercise 8D Key terms

1 W

2 T

3 R

4 P

5 Q

6 J

7 G

8 S

9 N

10 O

11 V

12 M

13 A

14 Y

15 X

16 U

17 F

18 B

19 E

20 L

21 C

22 K

23 D

24 I

25 H

Chapter 9 Reproduction

Exercise 9A Animal reproduction

1 Two sets of chromosomes

2 One set of chromosomes

3 A haploid sex cell

4 So that when they fuse their nuclei they create a diploid zygote

5 a diploid b haploid c diploid
 d haploid e diploid f haploid
 g diploid h diploid i haploid

6 A

7 D

8 Ovary and testes

9 a Testes
 b Ovary

10 D

11

	Sperm	Egg
Male/female	male	female
Relative size	smaller	larger
Site/organ of production	testes	ovary
Tail present	yes	no

12 The fusion of the nuclei of two haploid gametes to form a diploid zygote

13 Zygote

Exercise 9B Plant reproduction

1 Pollen and ovule

2 a Anther
 b Ovary

3 a X b Y c X d Y

4 A

5 D

6 D

7

Organism	Gamete	Organ of production	Haploid/Diploid
Plant	Pollen	Anther	Haploid
	Ovule	Ovary	Haploid
Animal	Sperm	Testes	Haploid
	Egg	Ovary	Haploid

8

Cell type	Gamete?	Plant/Animal	Haploid/Diploid
Liver	N	Animal	Diploid
Xylem	N	Plant	Diploid
Egg	Y	Animal	Haploid
Pollen	Y	Plant	Haploid
Zygote	N	Both	Diploid
Sperm	Y	Animal	Haploid
Ovule	Y	Plant	Haploid

9 Row 1: true; row 2: false / ovary; row 3: false / zygote

Exercise 9C Skills of scientific inquiry

1 a Wheat plant and rhesus monkey
 b 1:3
 c 100 %
 d 22
 e 92

Exercise 9D Key terms

1 F
 2 E
 3 A
 4 I
 5 C
 6 D

- 7 B
- 8 H
- 9 J
- 10 K
- 11 G
- 12 L

Chapter 10 Variation and inheritance

Exercise 10A Variation

- 1 The individual differences in a species arising from combining genes from two parents / Variation can arise from mutations and / or effects of the environment
- 2
 - a Variation where measurements fall into distinct groups
 - b Variation where there is a range of values between a minimum and a maximum
- 3
 - a
 - i One gene controls the inheritance of a characteristic
 - ii Many genes control the inheritance of a characteristic
 - b single gene – discrete
polygenic – continuous
- 4
 - a continuous b discrete
 - c continuous d discrete

Exercise 10B Inheritance

- 1
 - a A segment of DNA on a chromosome that codes for a specific protein
 - b Different form of a gene
 - c An organism's physical appearance, or expressed traits
 - d An organism's genetic makeup, or combinations of alleles
 - e An allele that is always expressed when present; only require one such allele to be expressed

- f An allele that is masked when a dominant allele is present; need two such alleles to be expressed
- g Both alleles are the same
- h Both alleles are different
- i Parental generation in a genetic cross
- j First generation of offspring from a genetic cross
- k Second generation of offspring usually from crossing the first generation
- l A cross in which only one characteristic is studied

- 2 Fertilisation is a random process / involves an element of chance
- 3 C
- 4 B
- 5 Row 1: false / alleles; row 2: false / continuous; row 3: false / recessive; row 4: false / phenotype; row 5: true

- 6
 - a F_1 and F_2
 - b P and F_2

c

	r	r
R	Rr	Rr
R	Rr	Rr

d

	R	r
R	RR	Rr
r	Rr	rr

- e 3 red : 1 white f 1RR : 1Rr : 1rr

- 7
 - a B and D b A and B c A and C
 - d C and D e D f A
 - g B h C
- 8
 - a Dd non-roller
 - b 50 %
 - c Fertilisation is a random process and involves an element of chance

- 9 a Monsur has both a dominant and recessive allele but is sighted
- b Row 1: hh non-sighted
Row 2: Hh sighted
- c 75 %

Exercise 10C Key terms

- 1 L
- 2 J
- 3 I
- 4 E
- 5 F
- 6 M
- 7 N
- 8 H
- 9 P
- 10 Q
- 11 O
- 12 K
- 13 U
- 14 D
- 15 G
- 16 B
- 17 S
- 18 A
- 19 C
- 20 T
- 21 R

Chapter 11 Transport systems – plants

Exercise 11A Structure and functions

- 1 Root, stem, leaf

Leaf structure	Number in diagram	Function/Description
Upper epidermis	6	Thin, transparent layer which allows transmission of light to the cells beneath
Palisade mesophyll	4	Tall cells packed with chloroplasts to maximise absorption of light and therefore photosynthesis
Spongy mesophyll	3	Large air spaces to maximise gas exchange
Vein	7	Transportation of sugars and water/minerals (composed of xylem/phloem)
Lower epidermis	2	Thin layer on underside of leaf containing many stomata
Guard cell	5	Open and close stomata
Stomata	1	Gap between guard cells which allow the evaporation of water during transpiration and the exchange of gases into/out of the leaf

- 3 Osmosis and active transport
- 4 Long root hairs increase surface area and maximise absorption of water and minerals
- 5 Water/minerals are drawn up through the stem in vessels called xylem

Vessel	Structure	Function
Xylem	Dead cells lined with lignin	Transport water/minerals up from roots to leaf
Phloem	Living cells with sieve plates and associated companion cells	Transport sugars up and down plant

- 7 Water absorbed into root hairs from soil by osmosis; transported from root to leaf via xylem vessels in the stem; water is lost by evaporation from the leaf via stomata
- 8 Transpiration is the process of water moving through a plant and its evaporation through the stomata
- 9 a increase b decrease
c decrease d decrease
- 10 B
- 11 D
- 12 D
- 13 Row 1: false / leaves; row 2: true; row 3: true; row 4: false / decreases; row 5: false / sugar

Exercise 11B Skills of scientific inquiry

- 1 a As the temperature increases from 0 to 30 ° C, the distance travelled by air bubbles (and therefore transpiration rate) increases from 0mm to 10 mm; from 30 to 60 ° C, the distance travelled by air bubbles decreases from 10 to 0 mm
- b As temperature increases, transpiration rate also increases, until the transpiration rate falls to 0
- c Same potometer used/same scale/same beaker/same species of plant
- d Light intensity/surface area of plant/humidity/wind speed
- e Repeat the experiment at these temperatures several times
- f Keep everything the same except replace the plant with a dead/boiled plant or other suitable answer
- g To allow a valid comparison by showing that the variable being investigated is responsible for the result
- h 350 %
- i 1:5
- j The enzymes will be denatured by the high temperature, therefore photosynthesis will no longer occur as it is an enzyme-controlled reaction

Exercise 11C Key terms

- 1 B
- 2 L
- 3 J
- 4 F
- 5 I
- 6 D
- 7 O
- 8 N
- 9 K
- 10 M
- 11 C
- 12 G
- 13 E
- 14 H
- 15 A

Chapter 12 Transport systems – animals

Exercise 12A Blood

- 1 Red blood cells, white blood cells and plasma
- 2 Nutrients, oxygen, carbon dioxide
- 3 Transport oxygen
- 4 Biconcave shape, no nucleus, contains haemoglobin
- 5 Structure increases surface area, which increases capacity to bind to and transport oxygen and also means more haemoglobin can be carried
- 6 Oxygen + haemoglobin ↔ oxyhaemoglobin
- 7 Immune
- 8 Destroy pathogens/produce antibodies
- 9 a Phagocyte and lymphocyte

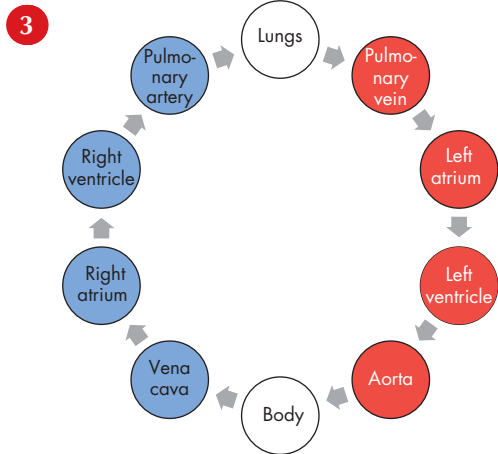
- b Phagocytes carry out phagocytosis by engulfing and digesting pathogens; some lymphocytes produce antibodies that destroy pathogens

- 10 Each antibody is specific to a particular pathogen

Exercise 12B Heart and circulatory system

- 1 P: vena cava Q: aorta
 R: pulmonary vein S: pulmonary artery
 W: left atrium X: left ventricle
 Y: right ventricle Z: right atrium

- 2 a Q T b P R S V c M N W X



4

Heart structure	Function
Atrium	Chamber where blood enters the heart. Pumps blood into ventricle
Ventricle	Pumps blood out of the heart through arteries
Heart Valve	Valve between atrium and ventricle, and between ventricle and artery. Prevents backflow of blood
Aorta	Artery that transports oxygenated blood to the body
Pulmonary artery	Artery that transports deoxygenated blood to the lungs from the heart

Heart structure	Function
Pulmonary vein	Vein that transports oxygenated blood to the heart from the lungs
Vena cava	Vein that transports deoxygenated blood to the heart from the body
Coronary artery	Heart muscle's own blood supply

5

Blood vessel	Structure	Function
Artery	Thick, muscular walls, a narrow central channel	Carry blood under high pressure away from the heart
Vein	Thinner walls, a wider channel. Veins contain valves to prevent backflow of blood	Carry blood under low pressure back towards the heart
Capillary	Thin-walled and have a large surface area	Forming networks at tissues and organs to allow efficient exchange of materials

- 6 a vein b artery c vein d capillary
 e vein f artery g artery
 h vein i capillaries j artery
 k vein l capillaries

- 7 Coronary artery
 8 Prevent backflow of blood
 9 Any two chosen and compared, showing how they differ, for example, arteries have thick, muscular walls where veins have thinner walls

- Arteries have thick, muscular walls, a narrow central channel and carry blood under high pressure away from the heart. Valves absent

- Veins have thinner walls, a wider channel and carry blood under low pressure back towards the heart. Veins contain valves to prevent backflow of blood
- Capillaries are thin-walled and have a large surface area, forming networks at tissues and organs to allow efficient exchange of materials. Valves absent

10 A

11 A

12 B

13 C

14 Row 1: true; row 2: false / biconcave; row 3: true; row 4: false / narrow; row 5: false / large

Exercise 12C Key terms

1 B

2 W

3 X

4 I

5 L

6 M

7 A

8 O

9 P

10 J

11 E

12 K

13 Q

14 V

15 U

16 H

17 T

18 C

19 D

20 R

21 F

22 G

23 Y

24 S

25 N

Chapter 13 Absorption of materials

Exercise 13A Features and functions

1 a Oxygen and glucose

b Aerobic respiration

c Carbon dioxide

d Diffusion

e Transported in blood to lungs to be expelled

2 a Tissues contain capillary networks to allow the exchange of materials at cellular level

b Large surface area, thin walls, extensive blood supply

c Increase the efficiency of absorption

3 Lungs

4 Lungs consist of a large number of alveoli; oxygen and carbon dioxide are absorbed through the thin alveolar walls to, or from, the many blood capillaries

5 A large number of alveoli provide a large surface area / they are only one-cell thick / are in very close proximity to capillaries

6 Oxygen and carbon dioxide

7 W: alveolus X: Carbon Dioxide

Y: Oxygen Z: capillary

8 Small intestine

9 a Digested in small intestine and diffuse through the walls into the blood

b Villus

10 The large number of thin-walled villi provides a large surface area; each villus contains a network of capillaries to absorb glucose and amino acids, and a lacteal to absorb fatty acids and glycerol

11 C

12 A

13 B

14 Y: lacteal Z: (blood) capillary

15 Row 1: false / oxygen; row 2: false / capillary; row 3: true; row 4: true; row 5: false / amino acids

Exercise 13B Key terms

1 I

2 C

3 E

4 K

5 A

6 B

7 D

8 F

9 G

10 H

11 J

Chapter 14 Ecosystems

Exercise 14A Ecosystems

1 ecosystem / plants / habitat / non-living / interact

2 a B

b C

3 A

4 B

5 B

6 a Grass

b Grasshopper / mouse

c Flow of energy

Hint Remember not 'what eats what'.

7 B

8 a All the variety of living things on planet Earth

b Pollution / deforestation / desertification / overfishing / overhunting / destruction of natural habitats

9 a Birds → foxes [prey]

Grasshoppers → birds [predator]

b The Sun

c Carrots / grasses / grains

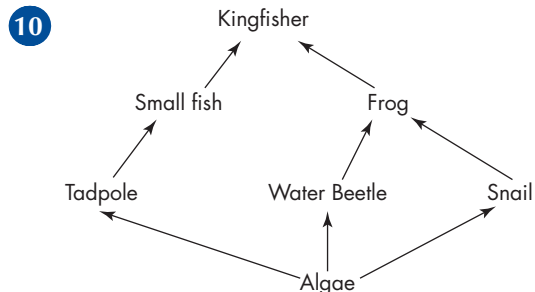
d Rabbits / mice / grasshoppers / birds

Hint Notice the birds are both predators and also primary consumers.

e The population of grasshoppers would decline

Owls eat only mice and grasshoppers so food source is now limited to grasshoppers

f Grains → grasshoppers → birds → foxes / owls



11 Row 1: true; row 2: false / consumer; row 3: true

Exercise 14B Niche

- 1 B
- 2 role / community / resources / ecosystem / light / nutrients / interacts / competition / predation / suitable temperature

Exercise 14C Competition

- 1 Competition is likely to be for all of the same resources
- 2 B
- 3 D
- 4 A
- 5 a Shape of beaks
b B and E
c Niche

Exercise 14D Key terms

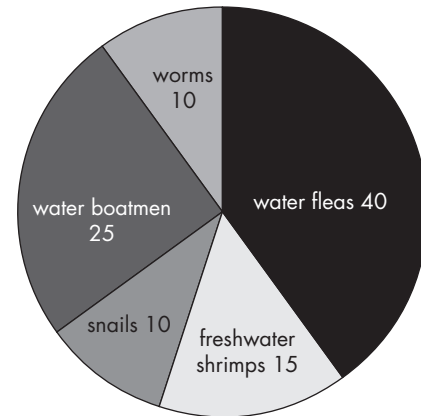
- 1 B
- 2 C
- 3 L
- 4 A
- 5 D
- 6 E
- 7 K
- 8 J
- 9 F
- 10 G
- 11 H
- 12 I
- 13 P
- 14 M
- 15 N
- 16 O

17 R

18 Q

Exercise 14E Skills of scientific inquiry

1 a



Hint Make sure you label each segment properly or have a key next to your diagram.

b 80

2 a 3

b 1

3 Only 1 and 3 can be concluded from this data

Chapter 15 Distribution of organisms

Exercise 15A Competition for resources

- 1 Grazing / grazing / biodiversity / species / ecosystem
- 2

Biotic factors	Abiotic factors
nutrient availability	pH
predators	light intensity
competition	moisture level
disease	temperature

Exercise 15B Measuring abiotic factors

- 1 a By using a digital device
b Speed of water / light intensity with respect to depth

- c The measurements were all taken in the early morning

By taking measurements at different times of the day

- 2 By wiping the probe after every reading

- 3 A

Exercise 15C Sampling

- 1 B

- 2 a Pitfall trap

- b Small invertebrate

- c To prevent birds eating trapped animals / stop water entering / provide dark and damp conditions / blend in with the environment

- d Some trapped animals may be eaten by other trapped animals / some animals may have flown away

By examining the traps very regularly / make sure the cover is arranged to prevent flying invertebrates from escaping

- 3 a 4

Human error / application of weedkiller / environment conditions not suitable for growth of buttercups

- b Use large quadrats

Take more samples

Exercise 15D Keys

- 1 a 1 narrow leaf shape 2

broad leaf shape 3

- 2 blue-coloured petals bluebell

yellow-coloured petals wild daffodil

- 3 variable number of petals present lesser celandine

fixed number of petals present 4

- 4 reddish purple-coloured petals red nettle

pale yellow-coloured petals wild primrose

Hint This is only one example of a suitable key. Try to construct a different one.

- b broad leaves; orange-coloured petals that are arranged in a daisy-shape; does not have a fixed number of petals

Hint Give all the information contained in the key.

- 2 1 Wings visible 2

Wings not visible 3

- 2 Two clear antennae on head thrips [A]

Antennae on head not clear dragonfly [B]

- 3 8 legs present wolf spider [E]

not 8 legs present 4

- 4 long elongated body walking stick [C]

short fat body scarab beetle [D]

- 3 a B

- b flat and blunt needles which bend upwards / needles not in bundles / cones have papery scales / leaves needle-shaped / large brown cones

- c One

- d *Pseudotsuga menziesii* and *Abies concolor*

Exercise 15E Effect of biotic and abiotic factors

- 1 Habitats require grazing to maintain their structure and composition upon which a variety of plants and animals depend for their survival

- 2 abiotic / sunlight / cold / temperature / nutrients

3 C

4 B

Exercise 15F Indicator species

1 Row 1: false / presence or absence

2 Indicator species

Exercise 15G Key terms

1 G

2 H

3 J

4 A

5 B

6 C

7 D

8 E

9 F

10 I

Exercise 15H Skills of scientific inquiry

1 a 1 cm average 7 10 cm average 7.2

b 1 cm 6.7 – 7.4 / 0.7 10 cm 6.9 – 7.8 / 0.9

c Small sample size / should be increased

Small area being investigated / should be increased

Too few depths sampled / more depths should be investigated

d Abiotic

2 B

3 a 80 %

b Grass

c Dandelion

d Chickweed at base / top of slope

e Throwing the quadrat randomly

f The moisture content of the soil / light intensity / pH of the soil

Chapter 16 Photosynthesis

Exercise 16A Two-stage process

1 Photosynthesis / two / food / light / chlorophyll / chloroplasts / ATP / water / hydrogen / carbon / glucose(sugar) / oxygen

2 C

3 Row 1: false / sunlight; row 2: false / chloroplasts; row 3: true

4 a Enzymes

b Temperature / substrate concentration / pH

5 a P: water / Q: carbon dioxide
R: hydrogen

b Carbon fixation

c Oxygen

d To form cellulose / starch or used as a respiratory substrate

e It joins with hydrogen to form carbohydrate

6 a The half in the jar would be starch free

The half exposed to the air would have starch present

b Carbon dioxide is essential for photosynthesis to take place

c Cover part of a leaf with light-proof paper

7 a The reactions are controlled by enzymes which are sensitive to temperature

b Enzymes would be denatured

8 B

9 B

10

Process	Raw materials	Products	Energy
photosynthesis	carbon dioxide water	glucose oxygen	sunlight
aerobic respiration	glucose oxygen	carbon dioxide water	ATP-synthesised

11 D

Exercise 16B Use of sugar synthesised

- 1 A
- 2 D

Exercise 16C Limiting factors

- 1 a X : light intensity Y : temperature
 - b Enzymes that control photosynthesis work faster at higher temperatures
 - c Carbon dioxide concentration
 - d Mass of sugar produced (g)

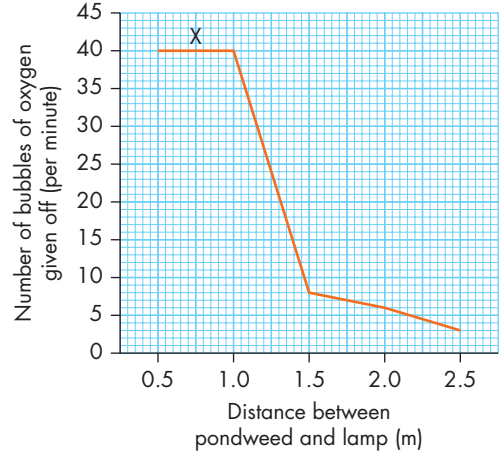
Hint Never miss out units.

- 2 B
- 3 C
- 4 B
- 5 B

Exercise 16D Keyterms

- 1 L
- 2 B
- 3 J
- 4 D
- 5 C
- 6 K
- 7 E
- 8 F
- 9 G
- 10 H
- 11 A
- 12 I
- 13 O
- 14 M
- 15 P
- 16 N

Exercise 16E Skills of scientific inquiry

- 1 a 

Distance between pondweed and lamp (m)	Number of bubbles of oxygen given off (per minute)
0.5	40
1.0	40
1.5	8
2.0	6
2.5	3

 - b As the light intensity / distance of the lamp from plant increases / decreases the rate of photosynthesis increases until the lamp is 1.0m from the plant; after this the rate of photosynthesis does not increase any further and remains at 40 bubbles of oxygen/minute

Hint Give a full explanation using the data. Don't just say 'it increases'.

- c Use a lamp of variable intensity instead of moving it / use a water-controlled bath for the pondweed / use an electronic bubble meter
- d C

Hint The other important process is respiration.

Chapter 17 Energy in ecosystems

Exercise 17A Food chains and energy

- 1 The transfer of energy from one organism to another
- 2 Heat, movement, undigested material, growth
- 3 a oak trees
 - b all except oak trees
 - c blackbirds, carnivorous insects, spiders
 - d caterpillars, aphids, slugs

- e caterpillars, aphids, slugs
- f blackbirds, carnivorous insects, spiders
- g none

Exercise 17B Pyramids

- 1 a A diagram to show the numbers of each organism at each trophic level in a food chain
 - b A diagram to show the energy in organisms at each trophic level in a food chain
 - 2 a i Grass at bottom (widest), zebra above (less wide), lion above (less wide), flea on top (wider than both lion and zebra but less wide than grass)
 - ii Oak tree at bottom (narrowest), caterpillar above (widest), blackbird above (less wide than caterpillar but wider than oak tree), hawk at top (less wide than blackbird but wider than oak tree)
 - b Normal pyramid shape with oak tree at bottom and hawk at top
 - c Only one oak tree at the bottom of pyramid so a narrow base needed, but the energy in the one oak tree is greater than the energy in all the organisms above, so a wider base is found in a pyramid of energy
- 3 Row 1: false / lost; row 2: true; row 3: false / energy
 - 4 C
 - 5 D

Exercise 17C Key terms

- 1 J
- 2 I
- 3 B
- 4 H
- 5 A
- 6 E
- 7 F

- 8 D
- 9 G
- 10 C

Chapter 18 Food production

Exercise 18A Food yield, fertilisers and nitrates

- 1 Increasing, which results in an increased demand for food production
- 2 a Fertilisers and pesticides
 - b Fertilisers provide chemicals such as nitrates, which increase crop yield; plants and animals, which reduce crop yield can be killed by pesticides
- 3 Nitrates dissolved in soil water are absorbed into plants through the roots
- 4 Nitrates are used to produce amino acids, which are synthesised into plant proteins
- 5 Animals consume plants or other animals to obtain amino acids for protein synthesis
- 6 Fertilisers can be added to soil to increase the nitrate content of the soil
- 7 They can leach into fresh water
- 8 Choose any three: Fertilisers can leach into fresh water, adding extra, unwanted nitrates; this will increase algal populations, which can cause algal blooms; algal blooms reduce light levels, killing aquatic plants; these dead plants, as well as dead algae, become food for bacteria, which increase greatly in number; the bacteria use up large quantities of oxygen, reducing the oxygen availability for other organisms
- 9 Genetically modified (GM) crops can be used to reduce the use of fertilisers
- 10 D

Exercise 18B Pesticides and alternatives

- 1 Pesticides sprayed onto crops can accumulate in the bodies of organisms over time
- 2 As pesticides are passed along food chains, toxicity increases and can reach lethal levels

- 3 The build-up of toxic substances in living organisms
- 4 The use of biological control and genetically modified (GM) crops as alternatives to the use of pesticides
- 5 Natural predator to the pest
- 6 Plants could be engineered to become pest-resistant, reducing the need for pesticides
- 7 Row 1: false / increased; row 2: true; row 3: false / nitrates; row 4: true; row 5: true

Exercise 18C Skills of scientific inquiry

- 1 a As the years increase, the population also increases
- b 2:5
- c 300 %
- d 8000 million
- e Increased life expectancy, increased birth rate/reduced death rate due to improvements in medicine

Exercise 18D Key terms

- 1 G
- 2 I
- 3 K
- 4 C
- 5 L
- 6 J
- 7 B
- 8 D
- 9 E
- 10 F
- 11 H
- 12 A

Chapter 19 Evolution of species

Exercise 19A Mutation

- 1 A mutation is a random change to genetic material
- 2 Neutral mutations have no effect on an organism's survival chances; other mutations may increase the survival chances (confer an advantage) or decrease the survival chances (confer a disadvantage)
- 3 Spontaneous / random
- 4 They are the only source of new alleles
- 5 Environmental factors, such as radiation and some chemicals

Exercise 19B Adaptation and variation

- 1 New alleles (produced by mutation) can result in plants and animals becoming better adapted to their environment
- 2 An adaptation is an inherited characteristic that makes an organism well suited to survival in its environment/niche
- 3 Variation makes it possible for a population to evolve over time in response to changing environmental conditions

Exercise 19C Natural selection

- 1 When there are selection pressures
- 2 Survival of the fittest
- 3 The best adapted individuals in a population survive to reproduce, passing on the favourable alleles that confer the selective advantage; these alleles increase in frequency within the population
- 4 Species produce more offspring than the environment can sustain

Exercise 19D Speciation

- 1 Speciation is a process resulting in the formation of a new species
- 2 An isolation barrier separates a population into sub-groups; they can be geographical, ecological or behavioural

3 Geographical : river/mountain

Ecological : occupying different habitats or breeding areas, pH, or salinity

Behavioural : differences in courtship behaviour, physical differences which prevent mating, or failure of gametes to fuse

4 Speciation occurs after part of a population becomes separated into sub-groups by an isolation barrier; different mutations occur in each sub-population; natural selection selects for different mutations in each group, due to different selection pressures; each sub-population evolves until it becomes so genetically different that they are two different species

5 A

6 B

7 D

8 C

9 Row 1: true; row 2: false / adapted; row 3: false / more; row 4: false / selection; row 5: true

Exercise 19E Key terms

1 G

2 I

3 J

4 E

5 A

6 H

7 F

8 B

9 C

10 D

Scientific Literacy answers

Exercise 1

a The effect of a low-fat dairy diet on developing Parkinson's disease

b Risk of developing Parkinson's disease

c

Servings of low-fat dairy per day	Risk of developing Parkinson's disease (%)
three or more	1
less than one	0.6

d Consuming three or more servings of low-fat dairy every day increases risk of developing Parkinson's disease by 0.4 % compared to consuming less than one

e Many more females than males in study/ other factors may contribute to risk of developing Parkinson's disease/participants may not be honest in questionnaires/questionnaires only completed once every two or four years

Exercise 2

a The effect of an extremely low-calorie diet on type 2 diabetes

b Fat levels in the pancreas

c 25 %

d The extremely low-calorie diet reduced fat levels from 8 % to 6 % and reversed Type 2 diabetes

e Sample size too small / only 11 participants

Exercise 3

a The effect of temperature on plant growth

b Temperature

c

Temperature (°C)	Change in height (cm)
10	+5
20	+12
30	+10
40	+8

d The optimal temperature for plant growth is 20°C

e Not repeated at each temperature/ only done once at each temperature

Exercise 4

a The effect of pH on oxygen saturation

b pH

c

Analysis site	pH	Oxygen saturation (%)
River Styx	8.0	94
River Rapid	7.7	65
Running River	7.9	91.5

d As the pH of the river increases, the oxygen saturation increases; or vice versa

e Only one sample was taken from each river