

Sparx Science

A Level Transition Booklet
Answers



Biology



1. Cells

1.1 A: cell membrane

B: nucleus

C: cytoplasm

D: mitochondria

1.2 A: cell membrane

B: chloroplast

C: vacuole

D: cell wall

1.3 a) mitochondria

1.3 b) cell membrane

1.3 c) ribosomes

1.3 d) cytoplasm

1.4 a) vacuole

1.4 b) cell wall

1.4 c) chloroplast

1.5

Cell wall	Cell membrane
	✓
✓	
✓	
✓	

1.6 a) In plant cells only

1.6 b) To carry out photosynthesis to produce glucose for the plant.

1.7 a) Cell A

1.7 b) This cell contains more mitochondria which provide the cell with energy (from respiration).

1.8 You would expect to find lots of ribosomes in white blood cells because ribosomes carry out protein synthesis.

2.1

Eukaryotic cell	Prokaryotic cell
✓	
✓	
	✓

2.2 A: cell membrane

B: cell wall

C: cytoplasm

D: ribosomes

2.3 a) Bacterial cells

2.3 b) 4

2.4 a) Cell C

2.4 b) It does not contain a nucleus.

2.5

Type of cell	
Prokaryotic cell	Eukaryotic cell
	✓
✓	
	✓

2.6 In prokaryotic cells, DNA is loose in the cytoplasm/Prokaryotic cells have a DNA loop/chromosomal DNA (and plasmids). In eukaryotic cells, DNA is found in the nucleus.

2.7 a) Eukaryotic cell

2.7 b) It has membrane bound organelles/nucleus/chloroplasts. It has no plasmids/DNA loop.

3.1

Term	Definition
	The brightness of the image seen through the microscope
Resolution	The ability to distinguish two points that are close together as separate
Magnification	How many times larger the image is compared with the real object
	The amount of light passing through the specimen

3.2 slide, stain, cover slip

3.3 a) Electron microscope

3.3 b) They have a higher resolution. They produce highly detailed images.

3.4 More internal structures would be visible in greater detail.

The image would be in greyscale rather than colour.

3.5 a) Electron microscope

3.5 b) The image shows very fine surface detail.

4.1 $\times 400$

4.2 $8560\ \mu\text{m}$

4.3 $35\ \mu\text{m}$

4.4 $\times 20$

4.5 $43.2\ \text{mm}$

4.6 $20\ \mu\text{m}$

4.7 a) $\times 100\ 000$

4.7 b) The magnification of an electron microscope is higher.

Accept converse argument.

5.1 chromosomes

5.2 Any one from:

- growth/development
- replacement (of old cells)
- repair/heal (wounds).

5.3 The cells are genetically identical.

5.4 After DNA replication, one set of chromosomes is pulled to either end of the cell. The nucleus divides to form two new nuclei and then the cell membrane divides to form two cells.

5.5 The mass of DNA per nucleus doubles in preparation for mitosis. The mass of DNA during mitosis stays constant and then halves because two new nuclei are formed.

6.1 White blood cells/lymphocytes/phagocytes

6.2 Antitoxins

6.3 Protists, viruses

6.4 By releasing antibodies and by ingesting microbes.

7.1 inactive, antibodies, destroy, quickly

7.2 A lower percentage of vaccinated people develop the disease. A lower percentage of vaccinated people develop a severe case of the disease.

7.3 B, A, D, E, C

7.4 (-)80%

7.5 A

2. Transport processes

1.1 The movement of particles from a region of high to low concentration/down the concentration gradient.

1.2 a) Diffusion

1.2 b) The concentration of oxygen is lower in the cell.

Accept converse argument.

1.3 B

1.4 Accept any one of:

- organisms are not cube shaped
- organisms have specialised exchange organs/surfaces
- organisms have transport/circulatory systems
- organisms are not the same material all the way through.

1.5 a)

Arrow			
A	B	C	D
	✓		
✓			

1.5 b) diffusion

1.6 a) B

1.6 b) B

1.7 The gills have many projections giving a larger surface area/better access to water.

1.8 a) As the side length increases, the time (to go colourless) increases.

1.8 b) Repeat the method three times and calculate a mean for each cube size.

1.9 a) The amoeba has a large SA:V ratio

1.9 b) It increases the rate (of diffusion).

1.10 surface area, thin, blood

1.11 a) X: 6 : 1

1.11 b) Y: 3 : 1

2.1 The movement of water through a partially/semi-permeable membrane from a dilute to a concentrated solution/from a high to low concentration of water/down the water concentration gradient.

2.2 a) From A to B

2.2 b) There is a higher concentration of water in A, so water moves by osmosis.

2.3 Cell wall

2.4 The concentration of sugar was higher outside of the cell
Accept converse argument.

2.5 a)

From X to Y	From Y to X
✓	
✓	
✓	
	✓

2.5 b) B

3.1 B

3.2 It requires energy.

3.3 a) Mitochondria

3.3 b) Respiration

3.4 They move by active transport from an area of low to high concentration/against the concentration gradient.

3.5 They move by active transport because energy is needed to move ions from a lower to higher concentration/against the concentration gradient.

3.6 a) Active transport

3.6 b) Diffusion

3.7 diffusion, active transport

3.8 a) osmosis, active transport

3.8 b) The particles are too large (to fit through the membrane).

3. Transport and exchange systems

1.1 a) B

1.1 b) To transport oxygen around the body

1.2 a) It increases the surface area to volume ratio to increase rate of diffusion of oxygen into and out of cell.

1.2 b) More haemoglobin can fit in the cell so the cell can transport more/the maximum amount of oxygen.

2.1 a) Valves

2.1 b) To keep blood flowing in one direction/to stop the back flow of blood.

2.2



2.3

Blood vessel X	Blood vessel Y
✓	
✓	
	✓
	✓
✓	

2.4 A: capillary

B: vein

C: artery

2.5 Arteries have thicker/more muscular walls and a narrower lumen.

2.6 3 : 1

3.1 A: left atrium

B: right atrium

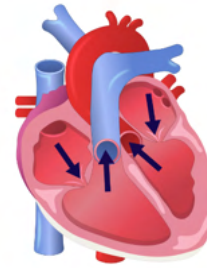
C: left ventricle

D: right ventricle

3.2 a) The atria fill with blood

3.2 b) Blood is forced into the ventricles

3.3



3.4 To keep blood flowing in one direction/to stop the back flow of blood.

3.5

Type of blood carried	
Deoxygenated blood	Oxygenated blood
	✓
✓	
	✓
✓	

3.6 The right ventricle/side (of the heart) pumps blood to the lungs. The left ventricle/side (of the heart) pumps blood around the body.

3.7 a) D

3.7 b) B

4.1

Life-long medication	Surgical procedure	Lifestyle change
		✓
✓		
	✓	
		✓

4.2 A disease that is not caused by pathogens./A disease caused by genetics/lifestyle./A disease that cannot be spread/transmitted between people.

4.3 They may smoke/drink alcohol/ have a family history of heart disease.

4.4 Less blood will flow through the artery which reduces the amount of oxygen reaching the heart.

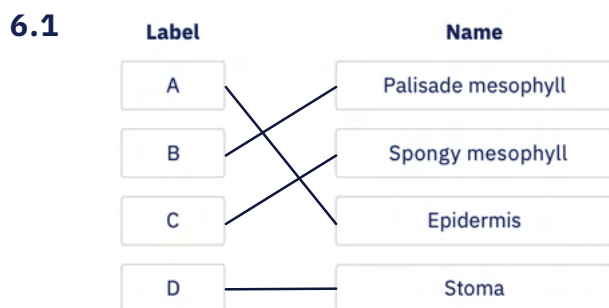
5.1 A: trachea
B: bronchus
C: bronchiole
D: alveoli



5.3 trachea, alveoli, diffusion, capillaries

5.4 It increases the rate of diffusion/ oxygen diffuses into the blood quickly to provide cells/tissues with sufficient oxygen

5.5 Oxygen moves by diffusion from a high to low concentration/down the concentration gradient



6.2 a) Guard cells

6.2 b) To open/close the stomata

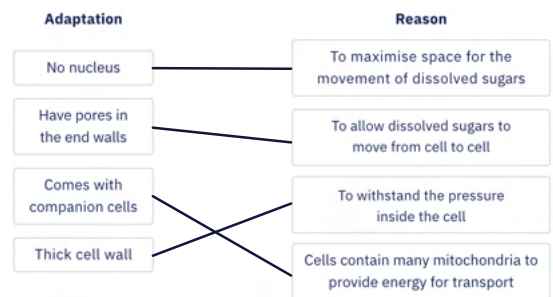
6.3 a) E

6.3 b) B

6.4

Phloem	Xylem
✓	
	✓
	✓
	✓

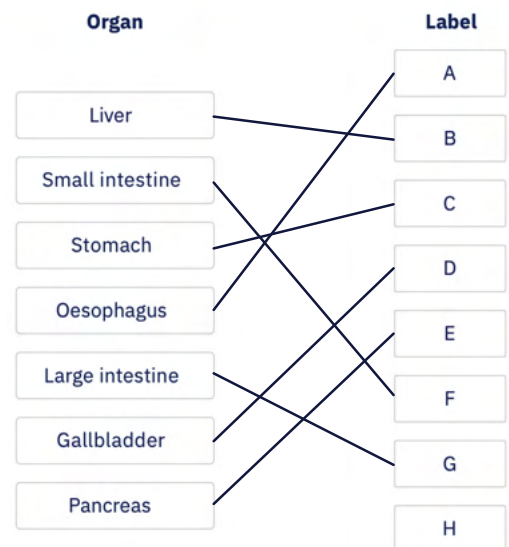
6.5



6.6 It is made of (dead hollow) tubes that are strengthened by lignin.

4. Enzymes and digestion

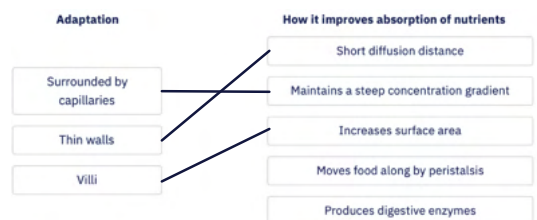
1.1



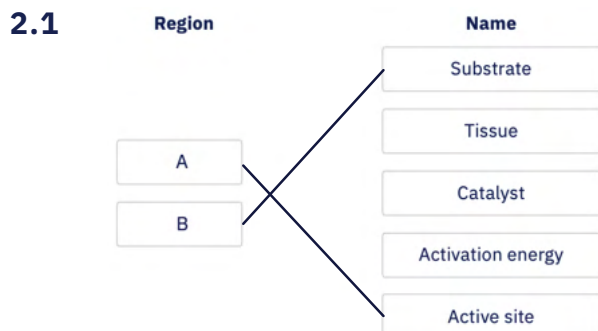
1.2 a) Liver

1.2 b) It emulsifies lipids.

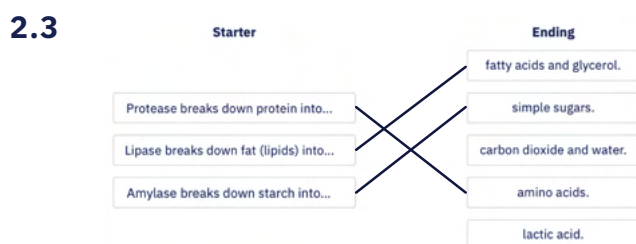
1.3



- 1.4** They have thin walls to create a short diffusion distance.
They have a rich blood supply/are surrounded by many capillaries so nutrients are transported away rapidly/to maintain a concentration gradient.



- 2.2** They catalyse/speed up the breakdown of molecules/are biological catalysts specific to certain substrates.



- 2.4 a)** Amylase/carbohydrase

- 2.4 b)** Catalyst

- 2.5 a)** A polymer is a long chain made up of repeating units called monomers

2.5 b)

Monomer	Polymer
✓	
✓	
	✓
	✓

- 2.6** Enzymes catalyse/speed up reactions. The active site matches the shape of the substrate/active site and substrate are complementary.

- 2.7** They denature/the active site changes shape.

- 2.8 a)** 90°C

- 2.8 b)** 6 g/min

- 2.9** They denature/the active site changes shape so the substrate cannot bind.

- 2.10** The activity is highest at pH 7 and decreases above and below pH 7.

- 2.11 a)** Student A, test 3

- 2.11 b)** 88 s

- 2.12 a)** 4

- 2.12 b)** They denature/the active site changes shape so the substrate cannot bind.

- 2.13 a)** The particles have little (kinetic) energy/the rate is low so starch is still present/is not broken down

- 2.13 b)** Amylase denatures/The active site changes shape so starch is still present/is not broken down

5. Genetics and inheritance

- 1.1** double helix

- 1.2** DNA, amino acids

- 1.3** All the genetic material/DNA of an organism.

- 1.4** In chromosomes in the nucleus

- 2.1** Genes from one organism are transferred to a different organism to give desirable characteristics.

- 2.2** A, C, B, D

2.3 Accept any one of these benefits:

- high yield
- cheaper production
- not weather dependent.

Accept any one of these risks:

- unknown long-term effects
- is unregulated.

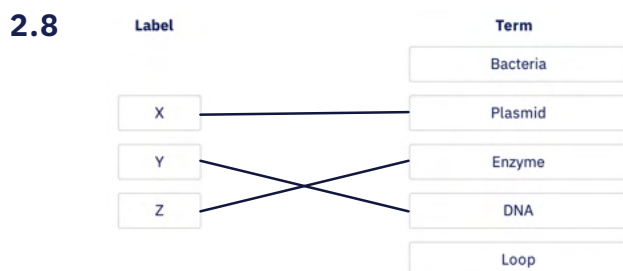
2.4 Viruses, Plasmids

2.5 a) (Restriction) enzymes

2.5 b) Plasmid/vector/virus

2.6 Bacterial cells must be cultured/ allowed to multiply/reproduce.

2.7 More can be produced so the sample is less likely to be contaminated/the hormone is less likely to be rejected/the hormone is more likely to be effective.



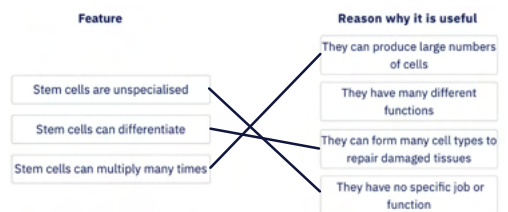
3.1 Meristem

3.2

Embryonic stem cells	Adult stem cells
	✓
	✓
✓	
	✓
✓	

3.3 a) Diabetes, Paralysis

3.3 b)



3.4 Stem cells could divide uncontrollably which could lead to cancer.

3.5 Stem cells undergo differentiation/ specialisation into neurone/nerve cells.

4.1 a) 46

4.1 b) 23

4.2 meiosis

4.3 a) 46

4.3 b) 23

4.4 C, B, A, D

4.5

Type of cell division	
Meiosis	Mitosis
	✓
✓	✓
✓	

4.6 a) Cell division

4.6 b) Chromosomes/genetic information is copied/duplicated.

5.1 Only one parent is involved

5.2 16

5.3

Type of reproduction	
Asexual	Sexual
	✓
✓	
	✓
✓	
	✓

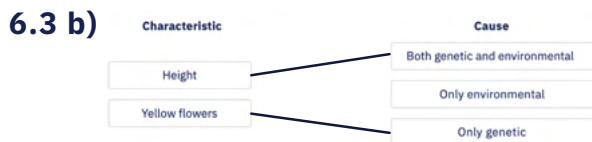
- 5.4** Involves two parents/gametes with offspring inherit genes/alleles from both parents/the mixing of genetic information.

6.1

Type of variation	
Genetic	Environmental
	✓
✓	
	✓
✓	
✓	

- 6.2** discontinuous

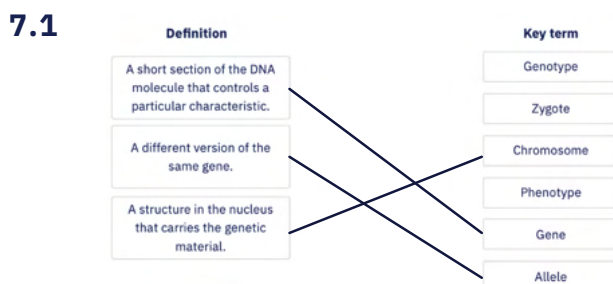
- 6.3 a)** Phenotype



- 6.4** A change in DNA/chromosomes/alleles.

- 6.5 a)** The dark-winged/mutated version

- 6.5 b)** The dark-winged moths were more camouflaged, so fewer of these moths were eaten/more of these moths survived to adulthood. This means the genes for dark wings were passed on to offspring /the dark winged moths were more likely to survive and reproduce.



- 7.2 a)** 23

- 7.2 b)** 46

- 7.3 a)** Genotype

- 7.3 b)** Phenotype

- 7.4 a)** Homozygous

- 7.4 b)** Heterozygous

7.5

Recessive allele	Dominant allele
	✓
✓	
✓	
	✓

- 7.6** The allele for curved wings is recessive and the allele for straight wings is dominant

- 7.7** Eye colour is the result of multiple genes, rather than single gene inheritance

- 7.8 a)** black

- 7.8 b)** Bb

7.9

Genotype	Description
Rr	Heterozygous
rr	Homozygous recessive
RR	Homozygous dominant

- 8.1**

		Male parent	
		X	Y
Female parent	X	XX	XY
	X	XX	XY

- 8.2 a)** ff

- 8.2 b)** They are carriers of the CF gene (both Ff)

- 8.3**

	B	b
b	Bb	bb
b	Bb	bb

8.4 a)

	g	g
G	Gg	Gg
g	gg	gg

8.4 b) Genotype: gg

Phenotype: yellow

8.4 c) Homozygous recessive

8.5 a) Parents A and B/F and G do not have TSD but offspring D/K/L have TSD.

8.5 b) A: Tt

B: Tt

8.6 dominant, heterozygous, always expressed

8.7 25%

8.8 The child will have dimples

8.9 a) Heterozygous

8.9 b) 0%

8.10 0.25

8.11 a) Someone with sickle cell anaemia and a carrier for sickle cell anaemia

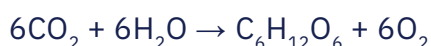
8.11 b) 1:1

8.12 25%

6. Energy transfers between organisms

1.1 word equation: carbon dioxide + water → glucose + oxygen

symbol equation:



1.2 a) chlorophyll

1.2 b) Absorbs sunlight

1.3 It takes in energy from the surroundings.

1.4 Light/sunlight is absorbed by chlorophyll/chloroplasts.

1.5 a) Oxygen

1.5 b) Photosynthesis

1.6 The plant with KOH cannot carry out photosynthesis so glucose is not produced.

1.7 Photosynthesis takes in carbon dioxide and water to synthesise glucose which increases the plant's biomass.

2.1 A factor that limits the rate of photosynthesis.

2.2 Accept any one of:

- carbon dioxide concentration
- amount of chlorophyll.

2.3 Carbon dioxide concentration

2.4 Increasing the temperature increases the rate of photosynthesis because it increases the movement/energy of particles/the rate of enzyme activity

3.1 Movement, Keeping warm, Building larger molecules

3.2 glucose + oxygen → water + carbon dioxide

3.3

Respiration	Photosynthesis
	✓
✓	
✓	
✓	✓

3.4 To release energy for movement/contraction/growth/repair.

3.5 Atmospheric air contains less carbon dioxide than exhaled air so flask B goes cloudy because carbon dioxide is produced by respiration in the woodlice.

3.6 a) 40°C

3.6 b) The enzymes are denatured

4.1 glucose → lactic acid

4.2 fermentation

4.3

Anaerobic respiration in humans	Anaerobic respiration in microorganisms
✓	✓
✓	✓
✓	
	✓

4.4 a) It would decrease

4.4 b) Fermentation occurs which produces carbon dioxide/a gas. This escapes the beaker, causing a decrease in the total mass of the beaker and its contents.

7. Homeostasis and control

1.1 a) Sensory neurone

1.1 b) Relay neurone

1.1 c) Motor neurone

1.2 a) Synapse

1.2 b) By neurotransmitters/chemicals

1.3 a) Receptors

1.3 b) Muscles in the leg

1.4 As an electrical impulse

1.5 Motor neurone

1.6 E, D, B, C, A

2.1 A response/reaction that is automatic/involuntary

2.2 A: relay neurone

B: motor neurone

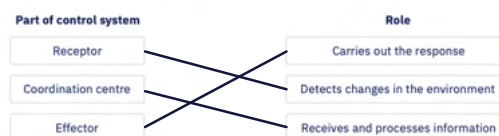
C: sensory neurone

2.3 The impulse travels across fewer synapses/travels a shorter distance.

2.4 retina, brain, muscles

3.1 The regulation/control of internal conditions to maintain the optimum function/activity.

3.2



3.3

Type of stimulus	
Internal	External
✓	
✓	
	✓
✓	

3.4 The internal temperature remains within a narrow range.

4.1 To maintain internal conditions within a narrow range

4.2 Stress/fear/danger

4.3 E, D, A, B, C

4.4 Adrenaline is released in response to fear/stress/danger so does not restore conditions in the body to a normal/baseline/optimum/is not involved in homeostasis.

4.5 Thyroxine increases (basal) metabolic rate/respiration and respiration releases energy/is exothermic.

5.1 glucagon
insulin

5.2 In the blood(stream)

5.3 a) Glycogen

5.3 b) Liver cells, Muscle cells

5.4 Blood glucose concentration decreases so glucose is taken in/ converted into glycogen/used in respiration by liver/muscle cells.

5.5 If Q becomes too high, A is released. If Q becomes too low, B is released.

Hormones A and B bring Q back to normal/optimum levels

5.6 Increasing their exercise.
Eating fewer carbohydrates/ sugars.

5.7 They cause glucose to move from the blood into cells

5.8 a) Patient A

5.8 b) Their blood glucose increases much more/their blood glucose does not drop so quickly suggesting they are unable to regulate their blood glucose/ cannot produce (sufficient) insulin.

5.9 They have high glucose levels.
They have high insulin levels

5.10 Their cells/liver/muscles absorb less glucose/convert less glucose to glycogen so glucose concentration in the blood remains high which stimulates the pancreas to release more insulin.

8. Ecology and evolution

1.1 The variety/range of species/ organisms (in an area)

1.2 Accept any one of:
- causes habitat loss
- contributes to global warming
- reduces food/shelter.

1.3 a) Area A

1.3 b) This area has a wider range of/ more different species.

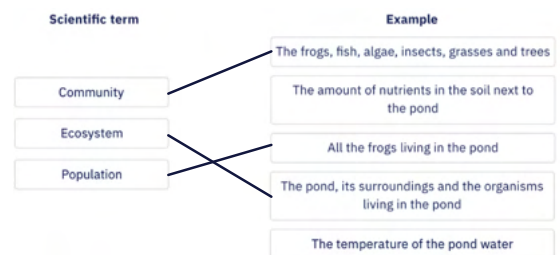
2.1 All the species and the environment are in balance with each other

2.2 interaction, abiotic, biotic

2.3 a) 4

2.3 b) 1

2.4



2.5 a) Forest B

2.5 b) In a stable ecosystem, population sizes/species numbers remain relatively constant, forest B has a decreasing number of species year on year.

3.1 a) Photosynthesis

3.1 b) Accept any one of:
- availability of water
- carbon dioxide concentration
- temperature
- soil pH
- light levels

3.2

Which species are affected?	
Plants	Animals
✓	
✓	✓
✓	✓

3.3 Pathogens are living organisms

3.4 Light intensity, Temperature, Moisture levels, Wind intensity, Air composition

3.5 a) Abiotic

3.5 b) Azalea, Pine tree

3.5 c) Maple tree

3.6 Accept any one of:

- the availability of food
- the presence of predators
- the presence of disease/ pathogens

3.7 a) The hare and lynx are plotted on different scales

3.7 b) Accept any one of:

- other predators
- the presence of disease/ pathogens
- the availability of food

3.8

Biotic factor	Abiotic factor
	✓
✓	
	✓
✓	

4.1 Natural selection

4.2 The gradual change in a species over time

4.3 E, A, B, C, D

4.4 A change in DNA/chromosomes/ alleles.

4.5 random, reproduce, gene, many

4.6 a) Dark moths would increase in number

4.6 b) Dark moths are better adapted/ more camouflaged, so they are better able to survive and reproduce.

4.7 Bacteria reproduce quickly.