

4.1 Cell biology

Trilogy Higher Topic Test Markscheme

Mark scheme 01

Nucleus-Eukaryotic cells

Permanent vacuole-Plant cells only

Plasmids-Prokaryotic cells

Allow 1 mark for 1 or 2 correct

[2 marks]

Mark scheme 02.1

B. Concentration of the sugar solution

[1 mark]

Mark scheme 02.2

Gained water

1

(Water moves) by osmosis

1

or

(Because) concentration of water outside the potato is greater than inside the cells / potato

Allow converse statements

(Because) concentration (of sugar solution) inside the potato is greater than outside the potato / cells

[2 marks]

Mark scheme 03.1

Any **one** from:

- Greater magnification
- Higher resolving power

Allow can see (smaller) sub-cellular structures / parts

Allow can see more detail (inside cells)

Allow reference to 3-D images

[1 mark]

Mark scheme 03.2

(a) Diffusion

1

(b) Active transport

Allow active uptake

1

[2 marks]

Mark scheme 04.1

Movement / spreading out of molecules / particles

Allow movement / spreading out of (named) substances / chemicals / gases / liquids

Ignore reference to membranes / cells

1

From (an area of) high(er) concentration to (an area of) low(er) concentration

Allow down / with the concentration gradient

Ignore along / across the concentration gradient

*Do **not** accept movement from / to a concentration gradient*

1

[2 marks]

Mark scheme 04.2

C. Increased carbon dioxide concentration in the air

1

D. Increased number of stomata that are open

1

[2 marks]

Mark scheme 04.3

Name of process: Active transport

1

Explanation:

(Because) energy is needed

1

(To move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell)

Allow (to move nitrate ions) against / up the concentration gradient

*Allow (because) there is a lower concentration (of nitrate ions) in the soil **or** (because) there is a higher concentration (of nitrate ions) in the root / cell*

Ignore reference to amount / number of nitrate ions

Ignore along / across the concentration gradient

*Do **not** accept if reference to molecules / atoms moving*

1

[3 marks]

Mark scheme 05.1

Red blood cell / RBC

Allow erythrocyte

Ignore blood cell unqualified

Ignore platelets

or

Bacteria / prokaryote

Allow named examples of bacteria

*Do **not** accept virus*

or

Xylem (cell)

[1 mark]

Mark scheme 05.2

Controls the (activities of the) cell

Allow contains genetic information / genes / DNA / chromosomes

*Do **not** accept brain*

*Do **not** accept controls substances entering / leaving the cell*

[1 mark]

Mark scheme 05.3

Any **one** from:

- (Cellulose cell) wall
- Chloroplast
Ignore chlorophyll
- (Permanent) vacuole
Allow starch grain

[1 mark]

Mark scheme 05.4

24 (mm) **or** 2.4 (cm)

*Allow in range 23 to 25 (mm) **or** in range 2.3 to 2.5 (cm)*

1

$$\frac{24}{0.06}$$

or

$$\frac{2.4}{0.06}$$

*Allow correct calculation from their measurement of **X** to **Y** in the range 2.3 cm to 3.5 cm **or** 23 mm to 35 mm*

1

($\times$) 400

*Allow correct magnification derived from their measurement in **mm**
Ignore rounding errors*

1

*An answer of ($\times$) 400 scores **3** marks*

*An answer of ($\times$) 40 scores **2** marks*

[1 mark]

Mark scheme 06

$$50 = \frac{43}{\text{size of real object}}$$

1

$$(\text{Size of real object} =) \frac{43}{50}$$

1

$$(\text{Size of real object} =) 0.86 \text{ (mm)}$$

1

$$(\text{Size of real object} =) 860 \text{ (}\mu\text{m)}$$

Allow correct conversion of their calculated value

1

*If no other marks awarded allow **1** mark for*

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

*An answer of 860 (μm) scores **4** marks*

[4 marks]

Mark scheme 07.1

Any **two** from:

Advantages:

- May be used to cure / treat (current / future) diseases
or
cure medical conditions
or
produce replacement cells / tissues / organs
Allow example e.g. diabetes / paralysis
Ignore used for medical treatments
- Cells / tissues of any type could be produced
Allow cells differentiate into many types
- Cells unlikely to be rejected by the patient
Ignore identical cells are produced unqualified
- Many cells produced
- Cells produced could be used for research
- Would reduce waiting time for organ transplants

Ignore references to cost

2

Any **two** from:

Disadvantages:

- Potential life is killed / destroyed
Allow embryo is destroyed
Ignore cells destroyed or wasted
- Shortage of donors / eggs
- Egg donation / collection has risks
- Do not yet know risks / side effects of the procedure on the patient
Allow may cause tumours / cancer
- May transfer (viral) infection
- Poor success rate to produce viable eggs / embryo

Ignore references to cost

Ignore unethical unqualified

Ignore references to religion / beliefs

2

[4 marks]

Mark scheme 07.2

Any **one** from:

- Meristem(s)
- **Tip** of shoot
Ignore stem and embryo
- **Tip** of root

[1 mark]

Mark scheme 07.3

Stage 1

Cell growth

or

Increase in number of organelles

Allow increase in named organelle e.g. ribosomes / mitochondria

1

DNA replicates

or

Two copies of each chromosome form

Allow DNA duplicates / doubles

Ignore genetic information replicates

*If this statement given as part of stage 2 allow **max 4** marks*

1

Stage 2 / mitosis

One set of chromosomes moves to each end of cell

Allow chromosomes separate or are pulled apart

1

Nucleus divides

Allow nucleus splits into two

1

Stage 3

Cytoplasm / cell membrane

divides to form two (genetically)

identical cells

Allow cytokinesis

1

Max 4 if correct sequence but no reference to stage numbers

Max 4 marks if no stage numbers given

Ignore names of phases

[5 marks]

Mark scheme 08.1

(Mass increased because) water entered by osmosis

1

From a dilute solution in the beaker to a more concentrated solution in the egg (cell)

Allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell)

Allow ref to water potential

Allow ref to 'strong' and 'weak' solutions

Ignore along / across concentration gradient

*Do **not** accept 'amount' in place of concentration*

1

Through a partially permeable membrane

Allow semi-permeable / selectively permeable membrane

1

[3 marks]

Mark scheme 08.2

(Ions are moved) from an area of low concentration to high concentration

Allow against the concentration gradient

Allow in terms of solution

*Do **not** accept molecules*

1

(By) active transport

1

(Which) requires using energy

*Do **not** accept idea of energy being created*

1

[3 marks]

4.2 Organisation

Trilogy Higher Topic Test Markscheme

Mark scheme 01.1

- 1 (smallest) - Nucleus
- 2 - Cell
- 3 - Tissue
- 4 - Organ

All in correct order

*Allow **1** mark for each consecutive pair of structures*

[3 marks]

Mark scheme 01.2

Any **one** from:

- Bladder
- Brain
- Heart
- (Small **or** large) intestine
- Kidney
- Liver
- Lung
- Pancreas
- Skin
- Stomach

Allow any organ found in an animal

Ignore blood

[1 mark]

Mark scheme
02.1

Is not caused by a pathogen / infective organism

Allow not caused by a microorganism / microbe

Ignore not caused by infection

Ignore named pathogen unless bacteria, virus and fungus all mentioned

1

(So) is not passed / spread (from person to person)

Allow cannot be spread / caught

Allow is not infectious / contagious

1

[2 marks]

Mark scheme
02.2

Reduced / restricted / stopped blood flow

It does not matter where blood flow is restricted to – heart / body

1

(So) less oxygen reaches heart (muscle / cells)

Must reference heart / it allow no oxygen reaches the heart (muscle / cells)

1

(So heart muscle / cells) cannot respire (enough)

or

(So heart muscle / cells) do not release (enough) energy

*Do **not** accept do not make / produce / create energy*

Ignore references to breathing / suffocation

Ignore blood clots / blockages

1

Allow 'it' for heart

[3 marks]

Mark scheme
02.3

Level	Description	Marks
3	Relevant points (factors / effects) are identified, given in detail and logically linked to form a clear account.	5-6
2	Relevant points (factors / effects) are identified and there are attempts at logical linking. The resulting account is not fully clear.	3-4
1	Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
	No relevant content	0

Indicative content

Medical risk factors:

- High blood pressure
- High cholesterol
- Diabetes
- Genetic factors
- Medications

Lifestyle risk factors:

- Smoking
- Obesity
- Lack of exercise
- High fat / energy diet
- Eating insufficient fruit / vegetables
- Alcohol
- High salt intake
- Exposure to air pollution
- Certain drugs / correct named drug

Examples of links:

- Smoking – high bp / cholesterol / fatty deposition
- Obesity – lack of exercise / high bp / cholesterol / fatty deposition / diabetes
- Exercise – obesity / bp / diabetes
- Diet – obesity / cholesterol / diabetes
- Alcohol – bp / cholesterol
- High salt intake - high blood pressure
- Genetic factors – bp / cholesterol / diabetes / obesity
- Medication – can affect blood / blood vessels / metabolism

The main discriminator is the quality of linking both lifestyle and medical factors are required for **level 3**.

[6 marks]

Mark scheme
03.1

Enzyme had not started to work.

Allow idea of not enough time (for digestion)

or

None of the starch had been digested / broken down

[1 mark]

Mark scheme
03.2

(Enzyme) digested / broke down starch to form sugar

1

(However) not all the starch was digested / broken down

1

[2 marks]

Mark scheme
04.1

C. Increased carbon dioxide concentration in the air

1

D. Increased number of stomata that are open

1

[2 marks]

Mark scheme
04.2

Osmosis

Allow diffusion

[1 mark]

Mark scheme 05

Level	Description	Marks
2	Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4 – 6
1	Facts, events or processes are identified and simply stated but their relevance is not clear.	1 – 3
	No relevant content	0

Indicative content

- Biuret reagent (allow CuSO_4 and NaOH) tests for protein.
- Add Biuret reagent to milk.
- Solution will turn (from blue) to lilac if positive.
- Iodine solution tests for starch (ignore iodine unqualified).
- Add iodine solution to milk.
- Solution will turn (from orange / brown) to blue / black if positive.
- Benedict's reagent tests for sugars.
- Add Benedict's reagent to milk and boil / heat (allow any temperature above 60 °C).
- Solution will turn (from blue) to (brick) red / brown / orange / yellow / green if positive.

For **level 2**, reference to all three food tests is required.

[6 marks]

Mark scheme 06

Blood is pumped to the lungs by one / right side of the heart

and

Blood is pumped to the body by the other / left side of the heart

Allow blood enters the heart twice for every (one) circuit around the body

[1 mark]

Mark scheme 07

Platelets

Allow thrombocytes

[1 mark]

Mark scheme 08

Any **two** from:

- Carbon dioxide
- Water
- Glucose
- Amino acids
- Lactic acid

Allow proteins / hormones / antibodies / vitamins / minerals / ions / fatty acids / glycerol

Ignore sugar / enzymes / nutrients / waste

[2 marks]

Mark scheme
09.1

Any **two** from:

- BMI / morphology / obesity level
*Allow mass / weight **and** height*
- Smoking habits
- Diet
Allow previous drinking habits
- Medication
Allow medical conditions
Allow drug use
- Family history of liver disease
- Fitness levels
Allow level of exercise
- Ethnicity
Allow race
- Area of UK they live in

Ignore genetic factors

[2 marks]

Mark scheme
09.2

$$2.55 - 1.60 (= 0.95)$$

Allow 1.60 - 2.55 (= -0.95)

Allow value for with meals in range 1.60 to 1.65 (for 1.60)

1

$$\left(\frac{0.95}{2.55} \times 100 = \right)$$

$$37 (.2549019608...) (\%)$$

Allow answer correctly calculated from values in ranges 1.60 to 1.65 and 2.50 to 2.60

Allow - 37(.2549019608...)(%)

1

[2 marks]

Mark scheme 10

(Cancer) cells cannot divide

or

(Cancer) cells are destroyed / killed

*Do **not** accept reference to the drug killing (cancer) cells*

1

(So) tumour doesn't grow / get bigger or tumour less likely to spread **or** tumour less likely to form secondary tumours

Allow cancer cells less likely to spread / metastasise

1

(Because) enzymes **A** and **B** are not working / active / effective / present

or

(Because) enzymes **A** and **B** are inhibited

Allow reference to both enzymes

Ignore enzymes unqualified

1

[3 marks]

Mark scheme
11.1

(By the guard cells) opening **and** closing the stomata

Ignore ref to guard cells being plasmolysed / turgid

[1 mark]

(Water is) transported in xylem

Ignore mechanism of water entering the roots

*Do **not** accept translocation*

1

Water evaporates (from leaves)

Allow loss of water vapour

1

Through the stomata

Allow between the guard cells

1

*If no other marks awarded allow **1** mark for reference to transpiration*

[3 marks]

4.3 Infection and response

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Mark scheme 01

B. Foxgloves

[1 mark]

Mark scheme 02.1

Toxins / poisons (secreted by / from / in bacteria)

[1 mark]

Mark scheme 02.2

Antibiotics

Allow named examples of antibiotics

[1 mark]

Mark scheme 02.3

Any **one** from:

- (Give chickens) antibiotics
Allow (give chickens) monoclonal antibodies
- Don't sell infected chickens / eggs
Allow don't sell the chickens / eggs
Ignore don't sell chickens / eggs
- Keep infected chickens isolated / indoors
Allow keep the chickens indoors
Ignore keep chickens indoors
- Slaughter the infected chickens
Ignore vaccination / chlorination / disinfection

[1 mark]

Mark scheme 03.1

C. A protist

[1 mark]

Mark scheme 03.2

Lower percentage of people with malaria when using (mosquito) nets

Allow converse if clearly describing people who do not use (mosquito) nets

Allow fewer people with malaria when using (mosquito) nets

*Allow **only** 1.2% of people with malaria when using (mosquito) nets*

Ignore reference to data from table unqualified

*Do **not** accept incorrectly calculated figures*

[1 mark]

Mark scheme 03.3

Any **one** from:

- Some people who use (mosquito) nets have malaria
Allow people can get malaria when they are not sleeping
- Data from only one area / part of Africa
- Size of group too small **or** sample size too small **or** only 476 people
Allow correlation does not imply causation
- Only 50 people did not use (mosquito) nets **or** uneven group sizes (nets vs. no nets)
- No other information about people considered
Allow examples of information not considered e.g. age, other medical issues such as sickle cell, whether taking anti-malarial medication, vaccination
Ignore ref to other factors unqualified
- People may have lied about using (mosquito) nets

[1 mark]

Mark scheme 03.4

Any value between 88 - 91

Allow decimal values

[1 mark]

Mark scheme 03.5

Any **one** from:

- Improved health care
*Allow examples of improved health care such as **more** / **cheaper** / **new** treatments / vaccinations / antibiotics*
- Use of mosquito control methods
*Allow descriptions such as spraying of insecticides / repellent **or** draining water holes **or** preventing mosquitoes from breeding*
- Changing behaviour to avoid being bitten (by mosquitoes)
*Allow descriptions such as wear long clothing **or** avoid going out at dusk*

[1 mark]

Mark scheme 03.6

Level	Description	Marks
2	Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6
1	Facts, events or processes are identified and simply stated but their relevance is not clear.	1-3
	No relevant content	0

Indicative content**Prevents pathogens from entering****Skin**

- Tough / dry / dead outer layer
- Skin acts as a barrier
- Sebum / oil on (surface of) skin
- Sebum / oil repels pathogens
- Scabs form over cuts **or** scabs form a barrier
- Platelets are involved in forming clots / scab

Stomach

- Contains (hydrochloric) acid
- (HCl) kills bacteria
- In food **or** in swallowed mucus

Eyes

- Produce tears
- Contains enzymes to kill bacteria
- Tears are antiseptic

Breathing system

- Trachea / bronchi / nose produce mucus
- Mucus is sticky
- (Mucus) traps bacteria
- (Mucus) carried away by cilia

Defends itself against pathogens inside the body

- Immune system / white blood cells (WBCs)
- WBCs engulf pathogens
- Antitoxins are produced
- (Antitoxins) neutralise toxins / poisons (produced by pathogen)
- Antibodies are produced
- (Antibodies) help destroy pathogens
- Memory cells (are formed)
- (Memory cells give a) more rapid response if pathogen re-enters

A **Level 2** response should refer to body defence **and** the immune system.

[6 marks]

Mark scheme 04.1

Fewer bacteria / pathogens in chicken / eggs / food

Allow fewer chickens / eggs will carry the bacteria / pathogens

Ignore chickens do not get disease / infected

1

(So) fewer bacteria are ingested (by humans)

Allow idea of fewer bacteria being passed on to humans in food

1

or

Fewer bacteria / pathogens ingested (by humans) (1)

Allow idea of fewer bacteria being passed on to humans in food (1)

(So) fewer toxins produced (1)

Ignore references to immunity unqualified

[2 marks]

Mark scheme 04.2

Wash hands before preparing food

Allow good food hygiene

Wash hands after using the toilet

Allow clean areas where a person has been ill

Allow do not shake hands (with someone who has food poisoning)

Ignore wash hands unqualified

[1 mark]

Mark scheme 04.3

Warmer weather so bacteria reproduce / increase faster

Ignore bacteria are killed at low temperatures

Allow food not cooked properly on barbeques

[1 mark]

Mark scheme 05

Level	Description	Marks
3	Relevant points (advice / reasons) are identified, given in detail and logically linked to form a clear account.	5-6
2	Relevant points (advice / reasons) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3-4
1	Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
	No relevant content	0

Indicative content**Precautions with reasons**

- Do not prescribe fluoroquinolone / antibiotics for mild infections
- Because they will get better due to the body's normal immune system
- Do not prescribe fluoroquinolone / antibiotics for viral infections / colds / flu
- Because antibiotics do not kill viruses
- If you do prescribe fluoroquinolone / antibiotics make sure the patient finishes the course
- Because any bacteria left may develop resistance, survive and reproduce rapidly (due to lack of competition)
- Only prescribe fluoroquinolone if the patient has the new strain
- Because routine use would lead to an increase in resistant bacteria

Other relevant content

- Doctors and nurses in the practice / hospital should be using antibacterial / alcohol hand wash between each patient **and** / **or** disinfectant to clean wards
- To kill (resistant) bacteria
- Doctors should isolate patients with this strain of bacteria
- To prevent other patients getting the resistant infection

[6 marks]

Mark scheme 06.1

A. 3 years

[1 mark]

Mark scheme 06.2

Too great a risk for ill person / patient
Allow may make their condition worse
Allow less risk to healthy person
Ignore references to immune system

1

Patient might be taking another drug
Allow unhealthy person might be taking another drug

or

Side effects of drug are easier to identify
Ignore to see side effects unqualified

1

[2 marks]

Mark scheme 06.3

Any **one** from:

- To prevent false claims
- To make sure the results / conclusions are correct / valid
Ignore references to accuracy, reliability or precision
- To avoid bias

[1 mark]

Mark scheme 07

(A)

(No change in population size) because no / limited cell division / reproduction

Allow (no change in population size) because bacteria / cells adjusting to environment / culture conditions

Ignore reference to growth unqualified

1

(B)

(Rapid increase in population size) as cells dividing rapidly as (plentiful) supply of nutrients / food

Allow rapid binary fission as (plentiful) supply of nutrients / food

1

(C)

(Population size stays the same) as rate of cell death equals rate of cell division

1

(D)

(Population size decreasing) as cells dying due to nutrients running out

or

(Population size decreasing) as cells dying due to toxins / carbon dioxide / cell wastes building up (in solution)

1

[4 marks]

Mark scheme 08.1

Any **one** from:

- Not everyone would go to the doctor

Allow not all cases recorded

Allow only medically confirmed cases recorded

Ignore some cases are unknown

- Sample will not always be sent for analysis
- Some cases not tested / diagnosed / confirmed

Allow idea that doctor may make a judgemental error or mis-diagnosis

[1 mark]

Mark scheme 08.2

96 / 95.5

*Allow **2** marks for correct rounding of 95.51724138*

*Allow **1** mark only for 95 or other incorrect rounding*

[2 marks]

Mark scheme 08.3

Level	Description	Marks
3	Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.	5-6
2	Relevant points (comparisons / reasons) are identified and there are attempts at logical linking. The resulting account is not fully clear.	3-4
1	Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
	No relevant content	0

Indicative content**Differences (after exposure to measles virus):**

- Greater number / higher concentration of antibodies produced
- Quantitative statement, e.g. 9 times higher **or** 0.8 to 7.2
- Antibodies produced sooner – idea of immediate response
- Antibodies produced quicker
- Antibodies stay (in higher concentration) for longer

Explanation

- White blood cells / leucocytes / lymphocytes / B cells
ignore phagocytes / macrophages
- Reference to previous exposure (of white blood cells) to pathogen / virus
- (White blood cells) recognise pathogen / virus / antigen
- Memory cells
- Production of specific / correct antibodies

[6 marks]

4.4 Bioenergetics

Trilogy Higher Topic Test Markscheme

Mark scheme 01.1

$$\frac{(18.5 + 19.3 + 19.5)}{3}$$

or

$$\frac{57.3}{3}$$

1

19.1 (cm³/hour)

Allow an answer correctly calculated using only two correct values

1

[2 marks]

Mark scheme 01.2

(a) 14.2

1

(b) Any **one** from:

- Scale / value was misread
Allow measurement error
- There was air / oxygen in the syringe / measuring cylinder / apparatus
- The lamp / light was moved
Allow light intensity changed
Ignore different bulb / lamp unqualified
- Temperature changed
- Had different mass / length of pondweed
- Pondweed had not acclimatised
Ignore human error
Ignore references to counting bubbles or time

1

(c) Did not use it in calculation (of mean)

1

[3 marks]

Mark scheme 01.3

Any **one** from:

- Light (intensity)
Allow distance / power / colour of lamp / light
- Carbon dioxide (concentration)
- Pondweed size / amount
- Pondweed species
Allow same (piece of) pondweed

*Do **not** accept temperature*

Ignore time

[1 mark]

Mark scheme 02.1

$$\frac{17}{53} \times 100$$

1

32.075472...

Allow correct rounding of this to at least 4 significant figures

1

32.1

Allow a correct reduction to 3 significant figures from an incorrect calculation for marking point 2

1

*An answer of 32.1 scores **3** marks*

[3 marks]

Mark scheme 02.2

$$\frac{132 - 78}{12}$$

allow $\frac{54}{12}$

Allow sequential deductions of 12 four or five times

1

4.5 (minutes) / 4 ½ minutes / 4 minutes 30 seconds / 4:30

*Do **not** accept 4:50 **or** 4 minutes 50 seconds*

1

*An answer of 4.5 minutes scores **2** marks*

[2 marks]

Mark scheme 03

(a) $X = 2800 / 52$

1

53.846153

1

54 (cm³)

Allow correct rounding of an incorrectly calculated value of stroke volume

1

An answer of 54 (cm³) scores 3 marks

(b)

	Mark
Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3-4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
No relevant content	0

Indicative content:

Effect of exercise

- During exercise body needs to transfer (more) energy.
- Energy transferred during respiration.
- Rate of respiration increases during exercise.
- (So) more oxygen is needed.

Effect of beta blockers

- Beta blockers reduce (the increase in) heart rate (during exercise).
- Beta blockers reduce stroke volume (or described).
- Beta blockers reduce cardiac output.
- (So) heart cannot supply oxygen fast enough / in sufficient quantity to muscle cells.

Effect on breathing rate

- Breathing rate increases to increase rate / amount of oxygen absorbed.
- Breathing rate increases to increase rate / amount of carbon dioxide removed from body.
- (But) increased breathing rate cannot fully compensate for changes in heart function.

A **Level 3** response should make links between all three sections of indicative content.

A **Level 2** response should attempt to link effect of exercise with oxygen / energy requirement **and** beta blockers to effect on heart function.

6

[9 marks]

Mark scheme 04

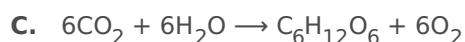
Any **three** from:

- Increased energy intake if more food eaten
Allow increased energy intake if more fat / carbohydrate eaten
Allow converse
Allow energy taken in when you eat
- If exercise more, more energy is transferred / released
*Allow if exercise more, respiration / metabolism increases **or** is faster*
Allow converse
Allow energy is transferred during exercise
*Do **not** accept energy is burnt during exercise*
- If more energy is taken in than is transferred body mass increases
or
If less energy is taken in than is transferred body mass decreases
Allow if less energy is transferred than is taken in body mass increases
or
If more energy is transferred than is taken in body mass decreases
- If energy intake = energy transferred body mass stays the same
*If no marks are awarded allow **1** mark for food eaten can increase body mass **and** exercise can decrease body mass*
or
*Allow **1** mark for if a lot of food is eaten **and** little exercise is done body mass increases*
Allow converse

*Max **2** marks if refer to energy being made / used / produced / created*
Allow reference to calories / joules for energy

[3 marks]

Mark scheme 05



[1 mark]

Mark scheme 06.1

Measure the volume of oxygen produced in a given time

or

When more oxygen is produced in a given time the rate of photosynthesis is faster

Allow when oxygen is produced faster the rate of photosynthesis is faster

Ignore the faster the rate of photosynthesis, the more oxygen is produced

Allow the slower the oxygen is produced the slower the rate of photosynthesis

or

Less oxygen being produced in a given time, the slower the rate of photosynthesis

A reference to rate is needed

Allow gas for oxygen

[1 mark]

Mark scheme 06.2

(a) 20 000 (lux)

Allow answers in range 19 500 to 20 500 (lux)

1

(b) There is a cost for heating the greenhouse

1

There is a cost for increasing the carbon dioxide in the atmosphere (of the greenhouse)

Allow there is a cost for lighting (in winter)

1

(Therefore) the additional costs might exceed the (additional) sale price / profit

or

(Additional) costs could not be recovered by increasing the sale price of the tomatoes

Ignore these additional costs would reduce profits unqualified

1

[4 marks]

Mark scheme 06.3

When there is no light there is no photosynthesis	1
(So) no oxygen is produced	1
(But) respiration happens (all the time) and oxygen is used	1
(Therefore) the net / overall oxygen production is negative / - 2 (arbitrary units) <i>Do not accept an answer of -2 (arbitrary units) unqualified</i>	1
[4 marks]	

Mark scheme 07

Starch (stores) have been converted to glucose <i>Ignore reference to residual glucose from previous photosynthesis</i>	1
(So the glucose can be) used for respiration / (named) metabolic reactions or (so the glucose can be) used to release energy <i>Do not accept idea of energy being produced / created / made</i>	1
(Because) there is no light to make (new / more) glucose by photosynthesis	1
[3 marks]	

Mark scheme 08

Reduced / no enzyme production / release (from pancreas)

Allow named example of enzymes

Ignore reference to hormones

1

Food is not broken down fully **or** food is not digested fully

Allow no food is broken down / digested

Allow example

1

Plus any **one** of the following routes for max **2** marks:

Mark as pairs

Less glucose / sugar absorbed **or** less glucose / sugar passes into the blood(stream)

1

(So) less glucose available for respiration so more (body / stored) fat used up in metabolism / respiration

1

or

Fewer amino acids absorbed **or** fewer amino acids pass into the blood(stream) (1)

(So) fewer amino acids are available for making new protein for repair / replacement (1)

or

Fewer fatty acids absorbed **or** fewer fatty acids pass into the blood(stream) (1)

Ignore glycerol

(So) fewer fatty acids available so less fat is stored in the body (1)

Ignore glycerol

or

Chemotherapy / radiotherapy causes nausea / loss of appetite (1)

(So) less intake of food (1)

[4 marks]

Mark scheme 09

Concentration gradient (of oxygen) is shallow(er) / less steep

1

(Therefore) less oxygen diffuses into blood / cells / gills

1

Allow idea that concentration gradient is negative (i.e. out of axolotl) (1)

So oxygen diffuses out of axolotl's blood / cells / gills (1)

(So) less (aerobic) respiration occurs so less energy is released / available

or

(So more) anaerobic respiration occurs so less energy is released / available

*Do **not** accept no respiration occurs*

*Do **not** accept energy production*

1

(So) less metabolism

Ignore reduced living processes unqualified

*Allow reduction of building larger molecules **or** movement / muscle contraction **or***

*keeping warm **or** urea formation **or** chemical reactions*

or

(So when) anaerobic respiration occurs, lactic acid is produced (and is toxic)

1

[4 marks]

4.5 Homeostasis and response

Trilogy Higher Topic Test Markscheme

Mark scheme 01

Any **four** from:

- (Stimulus is) detected by the receptor
 - (Initiates) an electrical impulse
 - (Impulse) travels via the neurones
 - Sensory, relay and motor
- Allow in this order only*

- Crosses synapses
- (Crosses synapses) as a chemical

[4 marks]

Mark scheme 02.1

To compare the effect of no caffeine

Allow as a control (group)

Allow to show the effect of caffeine

*Do **not** accept control variable*

[1 mark]

Mark scheme 02.2

Their reaction time was greater (after the drink)

Allow converse

Allow slower / longer for greater

*Do **not** accept anomalous result*

[1 mark]

Mark scheme 02.3

Any **two** from:

- (Same range of) age
- (Same) sex / gender
- (Same) height / weight / BMI
- All had no caffeine / medication / drugs earlier that day
- Equally tired or (same) amount of sleep
- Practice of the ruler drop test
- Starting point of ruler / hand
- *Allow height ruler dropped from*
- Same point to take measurement above / below the thumb / finger
- Using the same hand
- (Same) number of students in each group

*Do **not** accept volume / concentration of caffeine*

[2 marks]

Mark scheme 03

Regulation / control / maintenance of internal conditions (of a cell / body)

Allow keeping the internal conditions (of a cell / body) the same

1

For optimum (cell / enzyme activity)

Allow description of optimum functioning (of cell / body)

1

[2 marks]

Mark scheme 04.1

(Blood glucose increases after meal causing) insulin secretion

Allow (blood glucose increases after meal causing) insulin increase

1

Insulin causes glucose to enter cells / liver / muscles

1

(Insulin causes) glucose conversion to glycogen

1

Allow glucose converted to glycogen in cells / liver / muscles for 2 marks

(So) blood glucose decreases causing glucagon secretion

Allow increase in glucagon when blood glucose is low

1

Glucagon causes glycogen to be converted to glucose

1

Ignore incorrect organ secreting insulin / glucagon

[5 marks]

Mark scheme 04.2 Any **three** from:

- Age
- Height **and** mass
Allow BMI
- Proportion of males and females **or** group size
Allow sex of the participants
- (Same) severity of diabetes
- (Same) activity (during investigation)
- (Same) type of meal
- Dose of drug
- (Similar) blood glucose concentrations at start
Allow how much / type of food / drink consumed before
- Other health conditions **or** other drugs being taken
Allow may not have followed drug-taking regime beforehand

[3 marks]

Mark scheme 04.3 $\text{Mean} = 177.2 + 15.4$

[1 mark]

Mark scheme 05			
	Hormone	Name of gland which releases hormone	Target organ of hormone
	Luteinising hormone (LH)	Pituitary gland	Ovary
	Adrenaline	Adrenal gland	Heart / lungs / liver
	Glucagon	Pancreas	Liver / muscle

1 mark per correct row

[3 marks]

33
72
Mark scheme 06.1

or

0.45833...

1

0.46 (arbitrary units per hour)

Allow 0.47 (arbitrary units per hour)

Allow an answer given to 2 significant figures from an incorrect calculation in step 1 for

1 mark

1

An answer of 0.46 or 0.47 scores 2 marks

[2 marks]

Any one from:
Mark scheme 06.2

- (Lower dose so) fewer side effects
- (Patch lasts longer so) don't have to remember to take pill every day
- Hormone (from patch) goes directly into bloodstream so (contraception) unaffected by vomiting

[1 mark]

Mark scheme 07.1 (a) Any **three** from:

- Does not need IVF which is stressful / invasive
 - Higher chance of successful pregnancy as risk of miscarriage is low compared to (30%) success rate of IVF
 - The test is freely available
- Allow **Method 2** is not available to all couples who want it*
- The test can be carried out even once the mother is pregnant

3

(b) Any **one** from:

- Child will (definitely) not have CF
- Do not need to consider termination
- It is a way to have a child if couples are having fertility problems

1

[4 marks]

Mark scheme 08.1 The impulse has to travel to the brain (and back)
Allow it needs time to be processed by the brain

Allow the pathway is (a lot) longer
Allow more synapses

[1 mark]

Mark scheme 08.2
¹⁶
120
time

or

evidence of: $\text{speed} = \frac{\text{distance}}{\text{time}}$

1

0.013(33...)(s) **or** $\frac{1}{75}$

1

13(.33...) (ms)

*An incorrect answer correctly converted to ms scores **1** mark*

1

*An answer of 13(.33...) (ms) scores **3** marks*

[3 marks]

Mark scheme 08.3 As age (in years) increases the time for the muscle to contract increases

*Do **not** accept directly proportional*

1

At an increasing rate

Allow correct description of 'at an increasing rate'

1

[2 marks]

Mark scheme 09 **A** Thyroid (gland)

1

B Adrenal (gland)

1

C Ovary / ovaries

1

In this order only

[3 marks]

4.6 Inheritance, variation and evolution

Trilogy Higher Topic Test Markscheme

Mark scheme
01.1

Variation

Ignore genetic / environmental

[1 mark]

Mark scheme
01.2

Stronger / larger (shell)

1

(So) more likely to (survive and) breed

or

(So) more likely to (survive and) pass on genes

1

OR

(Better) camouflaged (1)

(So) less likely to be eaten and will breed more (1)

[2 marks]

Mark scheme 02

Asexual (reproduction)

Allow cloning

[1 mark]

Mark scheme
03.1

Chromosome(s)

Allow gene(s) / allele(s)

[1 mark]

Mark scheme
03.2

Double helix

[1 mark]

Mark scheme
03.3

Any **two** from:

- Diagnosis of inherited / genetic disorder
Allow research / understand genetic disorders
- Gene therapy **or** treatment of inherited disorders
- Understanding (human) evolution **or** understanding ethnic origins (of a person) **or** understanding ancestry
- Tracing human migration patterns

Allow other examples – e.g. identification of criminals (1) paternity determination (1)

Allow descriptions or named examples

[2 marks]

Mark scheme 04

Any **three** from:

- Mitosis produces two (daughter) cells but meiosis produces four (daughter) cells
Answers must be comparative
- One cell division in mitosis but two cell divisions in meiosis
- Mitosis produces cells with two of each chromosome, but meiosis produces cells with one of each chromosome
Allow mitosis produces diploid cells but meiosis produces haploid cells
*Allow mitosis maintains the number of chromosomes **or** mass of DNA **or** mass of genetic material but meiosis halves the number / mass*
*Allow mitosis produces cells with 23 pairs **or** 46 chromosomes but meiosis produces cells with 23 chromosomes*
- Mitosis produces genetically identical cells, but meiosis produced genetically different cells
Allow other correct differences between the processes of mitosis and meiosis

[3 marks]

Mark scheme 05

(Meiosis will not work because) number of chromosomes cannot halve

Allow chromosomes cannot form pairs

Allow chromosomes cannot split up evenly

[1 mark]

Mark scheme 06

Genetic variation (in offspring)

1

(So) better adapted survive

Allow reference to natural selection or survival of the fittest

1

(And) colonise new areas by seed dispersal

or

Can escape adverse event in original area (by living in new area)

Must imply new area

1

Many offspring **so** higher probability some will survive

*Allow bluebell example described (**max 3** if not bluebell)*

1

[4 marks]

Mark scheme 07

Any **two** from:

- Production of human insulin / medicines
- Crops resistant to diseases / pests
Allow examples such as potatoes resistant to blight
- Crops resistant to frost
- Crops resistant to drought
- Crops / foods with added nutrients
Allow examples such as golden rice with vitamin A gene
- Plants / crops with more / bigger fruits **or** higher yield
Allow examples such as larger tomatoes
- Crops with improved taste
- Crops with improved shelf life

[2 marks]

Mark scheme
08.1

Dd / dD

Allow heterozygous

1

Has **D** because has Dupuytren's **and** has **d** because child / person 6 is homozygous recessive **or** does not have Dupuytren's **or** is **dd**

*Allow has **D** because has Dupuytren's **and** person 1 and person 2 both passed **d** to child / person 6*

*Allow has **D** because has Dupuytren's **and** cannot be homozygous / **DD** or all the children would have Dupuytren's*

1

[2 marks]

Mark scheme
08.2

Female(s) / person(s) 3 / 11 / 12 have Dupuytren's

Allow some females have Dupuytren's

1

Females don't have Y chromosome

or

Dupuytren's is passed from fathers / 1 / 7 to daughters / 3 / 12, (so is not on the Y chromosome)

Allow only males have Y chromosomes

Allow females are XX

Allow Dupuytren's is passed from mothers / 11 to children / 15, (so is not on the Y chromosome)

1

[2 marks]

Mark scheme 09

- (a) Both parents shown as heterozygous

1

Derivation correct to show 1 unaffected, 2 carriers and 1 affected offspring.

		Woman	
		T	t
Man	T	TT	Tt
	t	Tt	tt

Allow correct derivation from incorrect gametes

1

- (b) **tt** identified as offspring with CF

1

- (c) Correct ratio / probability from their derivations of tt e.g. 1:3, 1 in 4, 25%, 0.25

1

[4 marks]

Mark scheme 10

Any **three** from:

- Fossils buried deep(er) so hard(er) to find
 - Fossils smaller so harder to find
 - More likely to be destroyed by geological activity / earthquakes / erosion
 - Oldest organisms were soft-bodied so most of the tissue decayed
- Allow oldest organisms were soft-bodied so there were very few fossils*
- Dating older fossils is hard
 - Older eras less researched by scientists because less to find
 - (Usually) unclear when one species evolves into another species (because not enough fossils found)

[3 marks]

Mark scheme 11

Ammonites = 350 (million years)

and

Trilobites = 266 (million years)

Allow range 345 to 355

1

84 million (years) or 84 000 000

Allow correct calculation from their answer for ammonites

Allow answers in standard form

1

[2 marks]

Mark scheme 12

(a) Class - *Mammalia*

Order - *Primates*

Family - *Lemuroidea*

Species - *catta*

All 4 correct = 2 marks

2 or 3 correct = 1 mark

0 or 1 correct = 0 marks

2

(b) Lemur catta

Ignore capitalisation / non-capitalisation of initial letters

Ignore italics / non-italics

Ignore underlining / non-underlining

1

[3 marks]

4.7 Ecology

Trilogy Higher Topic Test Markscheme

Mark scheme 01

Diseases - Biotic
Herbivores - Biotic
Temp - Abiotic
Water - Abiotic

Allow 1 mark for 2 or 3 correct

[2 marks]

Mark scheme 02

Any **two** from:

- (Some) plants grow faster / higher yield.
- Loss of habitat.
- Migration **or** change in distribution.
- Extinction.

Allow points made using examples

*If neither migration **or** extinction is given allow alters biodiversity for 1 mark*

Allow (in terms of extinction) death due to eg lack of water / food or increased disease

Ignore death unqualified

[2 marks]

Mark scheme 03.1

(Leaves block light near tree so) more light (as you move outwards)

Allow low light intensity under tree

Ignore Sun

1

For photosynthesis

Allow less photosynthesis under the tree

1

(Which) produces (more) glucose / proteins (for growth)

Ignore growth

Ignore food

Allow molecules, cell components or other correct substances instead of proteins

1

If no other mark awarded allow less water / ions / minerals / nutrients under the tree

[3 marks]

Mark scheme 03.2

Quadrat

Correct spelling only

1

Light meter

Allow lux meter

Allow light intensity meter

Allow light data logger

1

In this order

[2 marks]

Mark scheme 03.3

1.5(0) (m²)

Allow 15 000 cm²

[1 mark]

Mark scheme 03.4

As light (intensity) increased so did the percentage / cover of plants

Ignore directly proportional

Ignore positive correlation unqualified

1

Up to 100% / maximum at 175 (arbitrary units)

Ignore distance

1

[2 marks]

Mark scheme 03.5

Any **one** from:

- Repeat (investigation) around the tree
Allow repeat in different directions
- Repeat (investigation) for other trees / areas
- Sample every one metre
- Count the number of each species present (rather than percentage cover)

Ignore repeats unqualified

Ignore repeat at different times / days / seasons

Ignore different size quadrat

Ignore random sampling

[1 mark]

Mark scheme 04.1

B. Primary consumer

[1 mark]

Mark scheme 04.2

(Hydra have) less food

1

Because (graph shows) fewer Daphnia (with more fertiliser)

1

Allow other valid suggestions, e.g.

Fertiliser toxic to Hydra (1)

or

Fertiliser causes growth of algae (on surface) which block light and so die and decay

or

Eutrophication (1)

(Decay / eutrophication) uses up oxygen (so lack of oxygen for Hydra) (1)

[2 marks]

Mark scheme 05

Photosynthesis

Allow full description or full equation

Allow a symbol equation which is not balanced

[1 mark]

Mark scheme 06.1

Any **two** from:

- Global warming may be raising temperature of water and killing oysters
- Pollutants in the water may be toxic and kill the oysters

or

Increased acidity of the oceans is killing oysters

Allow correctly named pollutant with reason

- New competitors / triploid oysters are using up the normal food source
- New pathogens may be causing diseases
- New predators eating oysters

Ignore over harvesting

[2 marks]

Mark scheme 06.2

Level	Description	Marks
3	A judgement strongly linked and logically supported by a sufficient range of correct reasons is given.	5-6
2	Some logically linked reasons are given. There also may be a simple judgement.	3-4
1	Relevant points are made. They are not logically linked.	1-2
	No relevant content	0

Indicative content**For:**

- Oysters are available to eat all year **so** eating oysters has become very popular
- Cheaper to produce **so** more food for expanding population
- Oysters grow faster **so** more oysters for supermarkets / restaurants or more profit for farmers
- Stocks are replenished each year **so** more sustainable fishing
- They can harvest / sell all year **so** more stable and profitable for oyster farmers

Against:

- Carcinogen put into environment / oysters **so** may enter the food chain or cause cancer in humans
- Bigger triploid oysters may outcompete the smaller native diploid oysters **so** upset balance of the ecosystem / cause extinction
- People may not buy / eat them because they have used a carcinogenic chemical **so** reduced profit for farmers / suppliers / supermarkets / restaurants
- Farmers have to buy new seed oysters every time **so** more expensive

Other content:

- Shouldn't be eating the oysters until they are thoroughly tested
- Should be looking for alternative ways to get triploid oysters
- Should stop using triploid oysters until the effect on the (marine) environment is known
- Would replace lost oyster beds **but** could change the ecosystem
- Oysters available to eat all year **but** probably do not taste the same or have the same flavour

[6 marks]

Mark scheme 07

Any **four** from:

- Growing on other plants means support to absorb more light (for photosynthesis)
Allow to obtain water / minerals / ions / glucose from the other plant
Ignore nutrients

- Bright colours attract pollinators

or

Bright colours attract insects to transfer pollen

Allow fertilisation for transfer of pollen

- Large quantities of pollen (increases the likelihood of pollen transfer) and so more seeds / reproduction
- Tiny / light seeds will travel long distances to grow in new areas
Allow tiny / light seeds will travel away from competitors
- Many seeds mean many new plants so will out-compete other species
Allow many seeds so more (orchids) will survive

[4 marks]

Mark scheme 08

Level	Description	Marks
2	Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6
1	Facts, events or processes are identified and simply stated but their relevance is not clear.	1-3
	No relevant content	0

Indicative content

Reasons

- Tropical rainforests cleared for land
- That land used to raise cattle, plant rice or plant crops such as coffee
- Land cleared for mining
- That land used to grow biofuels or palm oil
- (Temperate) forests cut down for wood for building / paper
- (Temperate) forests cleared for farming (wheat / sheep)

Effects

- Less trees to take in carbon dioxide for photosynthesis
- Decay by microorganisms respiring releases carbon dioxide
- Burning waste wood releases carbon dioxide
- Build-up of carbon dioxide in atmosphere leads to greenhouse effect
- Build-up of carbon dioxide in atmosphere leads to global warming
- Consequences of global warming
- Habitat loss
- Leading to reduced biodiversity
- Leading to soil erosion

Must consider both reasons and effects for **Level 2**.

[6 marks]

Mark scheme 09

Can use the glyphosate / weed killer to kill weeds but not kill / affect crop
*Allow **only** kills weeds*

1

(So) less competition for light / water / minerals / ions
Allow less competition for nutrients
Ignore food / carbon dioxide / space

1

(So) crops have high(er) yield
Allow crops grow better / well

1

[3 marks]

Mark scheme 10.1

The variety of all the different species (of organisms) on Earth
or

The variety of all the different species (of organisms) in a habitat / area / ecosystem

[1 mark]

Mark scheme 10.2

Any **two** from:

- Takes minerals from the soil as crops are harvested / removed
Ignore nutrients
- Leads to soil erosion
- Farmers have to use fertilisers which pollute water / streams / lakes
- Burning crop waste produces carbon dioxide
Allow burning crop waste causes global warming
- Using large farm machinery causes soil compaction
Allow using large farm machinery releases carbon dioxide

[2 marks]