

Mark schemes

1

- (a) 1. Release of glucagon;
2. Leads to formation of glucose in liver (cells);
Reject: glucagon breaks down glycogen, or any other biological molecule
3. From non-carbohydrates / amino acids / fatty acids.
Accept: gluconeogenesis / references to glycogen as source of glucose

3

- (b) 1. Mutant mice (mRNA suggests) make a lot of (the) enzyme;
Accept: PCK1 made (for enzyme made)
2. Mutant mice use kidney / intestine (cells) to make glucose;
Accept: use other organ (than liver)
3. Normal mice do this much less / normal mice use liver cells.

3

- (c) 1. Differences significant;
Reject: references to results being significant once
2. Probability of difference being due to chance less than 0.01 / 1% / 1 in 100 / probability of difference not being due to chance more than 0.99 / 99% / 99 in 100.
Ignore: references to 0.05 / 5% / 5 in 100

2

[8]

2

- (a) 1. Splitting / breakdown / hydrolysis of ATP;
2. (Muscle) contraction requires energy / ATP;
Accept 'uses energy'. Reject idea of 'movement' of muscles requiring energy.
Reject suggestion that 'energy is produced'.
3. Use of ATP by myosin.
Accept a reference to any use of ATP by myosin. No credit for any further detail.

2 max

- (b) Fast because (lots of) ATPase allows rapid **hydrolysis** of ATP
OR
Slow because (lots of) ATPase allows rapid **synthesis** of ATP.
Accept either approach as some texts refer to ATPase as the enzyme at the end of the ETC in mitochondria.

1

- (c) 1. Need light to see colour / brown / yellow;
Requires reference to light.
2. Cannot see colour / brown / yellow with electrons / an electron microscope;
Requires reference to electrons / electron microscope.
Accept 'see black and white with electrons / electron microscope'.
3. No organelles are visible.
Accept appropriate named examples of organelles.

2 max

[5]

3

- (a) 1. Fields of view randomly chosen;
2. Several fields of view;
3. All same species (of animal / hamster);
Reject general statements related to sample size. All mark points relate directly to information provided in Resource A.
Accept 'all (Mesocricetus) auratus'.
4. Same muscle / organ used / only diaphragm used;
5. Used at least 8 (animals) in each (age) group.

4 max

- (b) (i) 15

Correct answer = 2 marks.

Allow 1 mark for showing

$$69 \div 4.6$$

OR

answer of 10 / 10.1 (correct calculation using fast in error.)

2

- (ii) 1. (Calculation) used mean (number of capillaries);
2. Variation in number of capillaries per fibre.

Note: maximum of 1 mark for this question.

Ignore reference to an anomaly or calculation errors.

1 max

- (c) (i) (Removing diaphragm means) animals / hamsters are killed.

1

- (ii) 1. (Suggests) significant (difference) between young and adult;
MP1, MP2, MP4 and MP5 can include use of figures but check figures are used correctly.
2. (Suggests) not significant (difference) between adult and old;
Statements related to 'results being significant / not significant' do not meet the marking points. It is the difference that is significant or not. However, only penalise this error once.
3. For slow **and** fast fibres;
This MP can be given in the context of either MP1 or MP2 but only allow once. As well as this context there must be a reference to 'both' types of fibre.
4. (Suggests) significant (difference) between young and old for fast (fibres)
OR
(Suggests) not significant (difference) between young and old for slow (fibres);
All aspects of either approach required to gain credit.
5. (Suggests) significant (difference) where means \pm SD do not overlap
OR
(Suggests) not significant (difference) where means \pm SD overlap;
All aspects of either approach required to gain credit.
6. Stats test is required (to establish whether significant or not).

4 max

[12]

4

- (a) (i) (Group) 5 / marathon runners.
Must only include this group and no other.

1

- (ii) 1. (5 / marathon runners) have highest percentage of slow fibres;
Maximum of 1 mark if the wrong fibres have been identified.
2. (Slow fibres) use aerobic respiration / aerobic respiration occurs in mitochondria;
Either approach requires identification of aerobic respiration.
3. (Slow fibres) best for endurance / long periods of exercise / to avoid fatigue.

2 max

- (b) 1. No (overall) change in number of fibres;
Reject any suggestion of an increase in number of fibres.
2. Increase in diameter of fibres;
'Size' without qualification is insufficient.
3. (Due to) training / exercise;
4. (Long-distance) cyclists have more / higher percentage of slow fibres (than fast);
A comparison is required to meet this MP.
5. Slow fibres of wider diameter than fast fibres;
6. (Long-distance) cyclists have more mitochondria;
7. (Long-distance) cyclists have more capillaries (in muscles).
Idea of 'more' (than non-athletes) is required to gain credit.
Accept converse (for non-athletes) in MP4, MP6 and MP7.

3 max

- (c) 1. Weightlifting favoured by / weightlifters have a high proportion of fast / low proportion of slow fibres
OR
Weightlifters have more fast / fewer slow fibres than non-athletes;
But (cannot tell because):
Reward for general statement or comparison with non-athletes.
For 'proportion', accept percentage (or idea of a ratio).
2. Do not know what 'weightlifters' (tested) were born with / had before started weightlifting / training
OR
Don't know if there has been a change (in proportion due to weightlifting / training);
3. No information about age / gender / number of weightlifters (in sample).
For this MP, accept another relevant factor that might affect 'weightlifter' e.g. weights lifted, sex, diet, ethnicity, country of birth.
Ignore general statements about 'other factors'.

2 max

[8]

5

- (a) 1. Ventricle pressure rises **then** blood starts to flow into aorta because pressure causes (aortic / semilunar) valve to open;
Accept times, eg ventricle pressure rises at 0.3 (25) seconds, followed by blood flow into aorta at 0.35 / 0.4 seconds
Idea of sequence is essential
Accept times
2. Ventricle pressure starts to fall **so** blood flow falls;
Idea of sequence is essential

2

- (b) 1. Thickness of wall increases **because** ventricle (wall) contracts;
Must be idea that increase in thickness is linked to contraction
Accept muscle for ventricle and systole for muscle contraction
2. Contraction **causes** the increase in pressure;
Accept thickening of wall

2

(c) *2 marks for correct answer*

1. Between 120 ± 5 ;;
Length of cycles varies slightly
2. Length of cardiac cycle correct but final answer wrong;
Length of cardiac cycle = 0.45 - 0.52

2

[6]

6

- (a) 1. To show the effect of the inhibitor / drug;
2. To show the effect of yoghurt (on its own does not affect blood glucose);

2

- (b) 1. Food is a factor affecting blood glucose / different foods contain different amounts of starch / glucose / sugar / carbohydrate;
Accept converse
2. To keep starch / fibre intake the same / similar;
Accept something in food which affects the inhibitor

2

- (c) 1. Fewer E-S complexes formed;
2. (With inhibitor) less / no starch digested to maltose ;
Require knowledge that maltose comes from starch
3. (So) less / no glucose from maltose;
Require knowledge that glucose comes from maltose
Accept no glucose
4. (So) less absorption of glucose (from gut);

2 max

(d) **Suitable reason; with explanation;**

Paired responses – do not mix and match

*Ignore references to correlation does not prove causation,
it could be due to other factors*

Examples,

1. Need larger sample / only 30 mice / only 15 mice in each group;
Accept small sample size
2. Might not be representative / anomalies might have a bigger or smaller effect;
Accept mean not reliable

OR

3. Investigation only lasted 20 days;
Experiment was not long enough
4. Can't see what longer term effects are;

OR

5. Fall in blood glucose is small / numbers from graph;
6. Mice with inhibitor still have a large rise in blood glucose / so don't know if differences significant;
Accept differences are due to chance

OR

7. No stats / SDs / SEs;
8. So don't know if differences significant;

OR

9. Blood glucose could continue to fall;
10. which could be harmful;

OR

11. No group without yoghurt;
12. So cannot compare to other groups;

2 max

[8]

7

- (a) 1. (Taxis is) movement towards / away from a stimulus / a directional response / movement (to a stimulus);
2. (Move towards) temperature they were used to / cultured in;
Movement towards temperature they were used to = 2 marks
- (b) 1. Hungry, so seeking food / in absence of food respond to temperature;
Ignore references to temperature and enzymes
Must be stated not inferred from other statements
2. Move towards temperature they were used to / cultured in;
3. Associate (this temperature) with food;
Accept they think food is here
Stated not inferred
4. (Then) stay in this temperature;
- (c) 1. (Dim) worms live in soil / dark / affected by bright light / dim light is like normal environment / what they are used to;
2. (Even) because worms might move towards / away from bright light / to avoid creating light gradient / prevent worms showing phototaxis / all parts of surface exposed to same light;
Accept to avoid kinesis due to light
3. (Dim light) ensures heat from light not a variable / heat from lamp could kill / dry out worms;
Not just to control variables / factors

2 max

3 max

2 max

[7]

8

- (a) 1. (In myelinated) action potential / depolarisation only at node(s);
2. (In myelinated, nerve impulse) jumps from node to node / saltatory;
3. (In myelinated) action potential / impulse does not travel along whole length;
The question is about speed of transmission, not repolarisation or related matters
Accept converse for non-myelinated

3

- (b) 1. Probability of obtaining this difference by chance;
Reject 'results' once only
This statement often split round 2.
2. Is less than 5% / less than 0.05 / less than one in twenty;
Accept is 4.7% / 0.047 but reject less than 4.7% / 0.047
Accept correct greater than 95% / greater than 0.95 arguments
3. Difference is significant;
Reject 'results' once only

2 max

- (c) 1. (All) dementia results lower (than control group) / non-dementia result higher;
2. Error bars do not overlap so differences are (possibly) significant;
Neutral results
Accept not due to chance / statistically significant
In this context, accept references to standard deviation
3. Dementia may be due to other factors / not only due to a lack of myelin;
Accept suitable named factor e.g. genetic
4. (Because) big / significant differences in myelin in different dementia;
Not just 'different'
5. Only small sample sizes / only one study / more data required;

4 max

[9]

9

- (a) (Formation of glycogen)
1. Glucose concentration in cell / liver falls below that in blood (plasma) which creates / maintains glucose concentration / diffusion gradient;
2. Glucose enters cell / leaves blood by facilitated diffusion / via carrier(protein) / channel (protein);
Not just diffusion

2

- (b) 1. Insulin sensitivity similar to / not (significantly) different from those with diabetes;
No values for non-obese, so comparisons with 'normal' not possible
2. Overlap of SDs;
Accept SE
3. Their sensitivity (to insulin also) improved by GBS;

2 max

- (c) 1. Sensitivity (to insulin) does increase;
This part of the question concerns spread of data, not overlap of SDs
2. But large SD / large variation (after GBS);
*Accept use of figures / use of SD values to make this point.
 Ignore ref to SE*
3. (So) some showing no / little change / get worse;
4. Do not know what sensitivity to insulin is of non-diabetics (who are not obese);
Accept 'normal' as non-diabetic

3 max

[7]

10

- (a) 1. (Phosphocreatine) provides phosphate / phosphorylates;
*Accept P_i or P in circle
 Reject phosphorus*
2. To make ATP;
*Accept:
 $ADP + CP \rightarrow ATP + C$
 Neutral – provides ATP*

2

- (b) One suitable suggestion;

eg

1. Genetic differences;
2. Level of fitness / amount of regular exercise done / mass of muscle;
3. Sex;
4. Ethnicity
5. Metabolic rate;
6. Number of fast / slow muscle fibres
Neutral lifestyle / diet / illness

1 max

- (c) 1. Fast muscle fibres used for rapid / brief / powerful / strong contractions;
 2. Phosphocreatine used up rapidly during contraction / to make ATP;
 3. (As people get older) slower metabolic rate / slower ATP production / slower respiration;
 4. ATP used to reform phosphocreatine;

4

[7]

11

- (a) Push – legume

Pull – grass;

Both needed for mark

1

- (b) 1. Set up tape measures on two sides of the plot / make grid of plot;
Allow 'Number each plant'. With this approach mp3 cannot be awarded.
 2. Use random number table / calculator / generator;
Allow 'Select from a hat' idea.

3. To generate coordinates;

3

- (c) 1. To prevent competition between the maize and the grass;
 2. For light / nutrients / water;

OR

3. Idea of limits movement of pest (between grass and maize);
 4. Only eating / damaging grass;

2 max

- (d) 1. Nitrogen-fixing bacteria convert nitrogen (in the air) into ammonium compounds (in the soil) which are converted into nitrates / nitrification occurs;
Accept 'ammonia' for 'ammonium compounds'.

2. Maize uses nitrates (in soil) for amino acid / protein / ATP / nucleotide production;

2. Must be in the context of maize.

Ignore ionic formulae unless only these are given.

2

- (e) 1. Reduced % damage to maize plants / increased maize grain yield;
2. Calculation to justify mp 1;
3. Standard deviation shows no overlap but need stats to show significance of this difference;
4. More profit / net income / greater income than additional cost (with push-pull);
5. \$322 extra / 408% more / \$401 v \$79 profit;
*Accept '\$350 extra income compared to \$28 extra spend'.
 Mp5 gains credit for both mp4 and 5*

3 max

[11]

12

- (a) (i) 1. Slower diffusion;
Accept description of diffusion eg 'movement down concentration gradient' but concept of slower is required
2. (Of) ions / Na⁺ / K⁺;
*Reference to ions is required. Reject other named ions, eg calcium ions
 Ignore references to synaptic transmission or rates of respiration*
- (ii) 1. Myelination / saltatory conduction;
Accept reference to presence of nodes of Ranvier
2. Axon diameter;
- (b) Keep everything the same but not in bath / at room temperature / same clothing as for immersion / sitting in empty bath / sitting in water at room temperature;
*Accept 'normal' or 'comfortable' as equivalent to room temperature
 Ignore reference to body temperature*
- (c) (i) (Find) the most common result / time / the result / time that occurs the most;
- (ii) Highest and lowest result / time;
Accept 'difference between highest and lowest results / times'

2

2

1

1

1

- (d) 1. (Which is based on) mean of 20 people / large (enough) sample;
This point is possible for students that suggest the difference is significant
2. (But) SE bars / confidence limits overlap;
This point applies whether 1 x SE or 2 x SE is used
3. Reference to 0.297 ± 0.0424 / 0.326 ± 0.0366 / confidence limits = 2 x SE;
This point rewards knowledge of use of 2 x SE (as per Students' Statistics Sheet)
4. (So) difference is **not** significant;
This point is only awarded after marking point 2 or marking point 3 has been given

3 max

[10]

13

- (a) 1. People swimming 100 m / group1 had higher heart rates than people swimming for 30 minutes / group 2;
2. (Trend is) as temperature increases heart rate increases for swimming 100 m / group 1;
3. No trend for swimming for 30 minutes / group 2;
4. (SD values show that) each set of results has little variation;
Four approaches but only 1 mark available
- (b) 1. Assumes that an increased HR is beneficial (whatever the temperature of the water);
2. (But) haven't measured the 'benefits' to health / increased heart rate may not be 'better';
3. No definition of better / flat out / better / flat out is subjective / based on opinion;
4. Only know the highest heart rate / time at highest heart rate not known;
5. Swimmers only tested once / only a short-term effect (on heart rate) / long-term effects are not known;
6. Distance covered in 30 minutes not known / might vary / time to complete 100 m not known / might vary / swimming ability might vary (among volunteers / between groups);
7. Groups may not be representative (of population);

1 max

4 max

[5]

14

- (a)
1. SAN sends wave of electrical activity / impulses (across atria) causing atrial contraction;
Accept excitation
 2. Non-conducting tissue prevents immediate contraction of ventricles / prevents impulses reaching the ventricles;
 3. AVN delays (impulse) whilst blood leaves atria / ventricles fill;
 4. (AVN) sends wave of electrical activity / impulses down Bundle of His;
4. Allow Purkyne fibres / tissue
 5. Causing ventricles to contract from base up;

5

- (b)
1. Atrium has higher pressure than ventricle (due to filling / contraction) causing atrioventricular valves to open;
Start anywhere in sequence, but events must be in the correct order.
1. Accept bicuspid, reject tricuspid
1. Allow: blood passes through the valve = valve open / blood stopped from passing through the valve = valve closed
 2. Ventricle has higher pressure than atrium (due to filling / contraction) causing atrioventricular valves to close;
 3. Ventricle has higher pressure than aorta causing semilunar valve to open;
Points 1, 2 and 3 must be comparative: eg higher 3. Allow aortic valve
 4. Higher pressure in aorta than ventricle (as heart relaxes) causing semilunar valve to close;
4. Allow aortic valve
 5. (Muscle / atrial / ventricular) contraction causes increase in pressure;

5

[10]