6.1 Organisms - Responses to their environment (A-Level Only) - Survival and response – Mark schemes

Q1.

(a) Only 3 neurones / nerve cells (in reflex arc)

1

(b) 1. Rapid;

2. Protect against damage to body tissues;

3. Do not have to be learnt;

4. Help escape from predators;

5. Enable homeostatic control.

2 max

(c) 1. Neurotransmitter only made in / stored in / released from pre-synaptic neurone;

2. (Neuro)receptors only on the post-synaptic membrane;

2

(d) 1. Axon **P** is myelinated;

2. So shows saltatory conduction / impulses jump between nodes of Ranvier

OR

3. Axon **P** has a larger diameter;

4. So less resistance to flow of ions.

*Mark as 1 & 2 **OR** 3 & 4*

2

[7]

Q2.

(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]

Q3.

(a) 1. Similarity − directional response (to a stimulus) / movement towards / away from a stimulus;
2. Difference − taxis (whole) organism moves <u>and</u> tropism a growth (response).

Must be clear which one, taxis or tropism, they are referring to
Taxis occurs in animals / motile organisms <u>and</u> tropism occurs in plants

2

(b) 1. Grow in direction of / towards (pull of) gravity;

Accept: tropism for growth
Ignore: pulled by gravity
Accept: positively geotropic / gravitropic

2. Grow away from salt;

Accept: negatively chemotropic / halotropic
1 and 2. Ignore: references to bends / moves

3. Salt has more effect (than gravity).

Accept: converse statement for gravity

Note: all three points may appear in one sentence

3

(c) 1. More carriers in (cell) **L** / lower in **R**;
*Accept: left for **L** and right for **R** / side nearer salt for **L***

2. (So) less IAA in (cell) **L** / more IAA in (cell) **R**;
*Accept: more IAA moves out of **L** / less IAA moves out of **R***

3. (So) more (elongation) growth in **L** / less (elongation) growth in **R**.
*Accept: less inhibition of growth in **L** / more inhibition of growth in **R**;*

3

[8]

Q4.

(a) 1. Kinesis;
Ignore any prefix

2. Movement is random / non-directional
OR
Insect is not moving towards a particular stimulus;

2

(b) 1. Less respiration so less gas exchange;

2. (So) spiracles open less so less water loss;

2

(c) Taxis;
Ignore any prefix

1

(d) No (no mark), the insect does not move in circles;

Shows kinesis / results similar to **Figure 1**;

2

(e) **For (max 1)**

1. The data show a positive correlation;
Must state this as the description is given in the stem.

2. Large sample / number of insects so valid / reliable / representative;

Against (max 1)

3. (however) there are overlaps in individual experiments at all humidities;

4. 70–90% humidity there is little / no change in movement / movement only increases after 76% humidity;
Accept any value in this range

2 max

[9]

Q5.

(i) arc shows 3 neurones;

(3 distinct neurones, one of which is in the grey matter, with correct route through dorsal and ventral roots and indication of synapses. Ignore position of cell bodies.)

1

(ii) neurones labelled sensory, relay / intermediate, motor;

1

(iii) muscle labelled as effector;

1

[3]

Q6.

(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

2 max

(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;

3 max

(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

[7]

Q7.

(a) Three changes described;;;

Neutral nucleus shrinks, since it doesn't

Eg

1. Formation / growth of vacuole;

2. Formation of starch grains / amyloplasts;

2. Accept starch grains get bigger

3. Movement of grains / amyloplasts towards bottom of cell;
Note − list rule applies

4. Cells get longer / wider / larger;

3 max

(b) 1. Grows sideways before starch grains form;
Q

2. Bending starts when / as grains form;

3. More bending as grains increase in number;
3. Ignore starch grain growth references

4. More elongation (of cells) / growth (of roots) downwards as starch grains increase / move;

5. Bending starts before grains move down;

6. Could be related to vacuole;
6. Ignore references to nucleus

3 max

(c) 1. (IAA) at bottom of root / where IAA concentration high inhibits expansion / elongation (of cells);
2 and 3 need reference to expansion / elongation, not just growth

2. (IAA) at top of root / where IAA concentration low leads to expansion / elongation (of cells);
2. Accept less inhibition

2

[8]

Q8.

(a) 1. (Seedlings) respond to light / are phototropic;
Reject: <u>roots</u> are positively phototropic / grow towards light

OR

Neutral: 'to control a variable'

2. (Only) measuring the effect of gravity / response to gravity;
Neutral: light affects growth / results

1

(b) 1. (Cells in) root tip detect gravity / respond to gravity;
Must refer to root tip and not just the root

OR

2. IAA / auxin is produced in the root tip;

1

(c) (i) 1. IAA / auxin moves to lower side / more IAA / auxin on lower side;
Accept: references to 'cell elongation' instead of 'growth'

2. Lower side grows less / slower / upper side grows more / faster / inhibits growth on lower side;

Note: if auxin is placed at upper side, mark point 2 can still be awarded

Need idea of 'less / slower' or 'more / faster' for mark point 2

2

(ii) 1. Less IAA / auxin (produced);

2. Lower side grows more / faster / less inhibition of growth on lower side;

Must refer to the lower side

2

[6]

Q9.

(a) Diffusion;

Ignore references to simple / facilitated

Accept active transport

1

(b) 1. Causes plant to bend / grow towards light / positive phototropism;

2. (Light) required for photosynthesis;

2

(c) 1. More kinetic energy / faster movement of molecules;

2. More diffusion;

Ignore references to opening stomata.

Answer should be in context of more but comparative statement only necessary once.

2

(d) (i) 1. Thick cuticle on upper surface / thin cuticle on lower surface / few stomata on upper surface / no stomata on upper surface;

2. More diffusion / shorter diffusion pathway (on lower surface);

1. Ignore cuticle only on upper surface. Ignore references to more or less waxy.

2. If candidate writes about stomata accept ref to greater area for diffusion.

2

(ii) Different species have different (qualified) properties;

Eg cuticle thickness

Leaf size

Number of stomata

1

[8]

Q10.

(a) *two environmental or developmental variables <u>and</u> explanation;*

examples,

all plants of the same age, so same time for cell divisions / differentiation;
all plants given the same watering, so same amount of water for cell expansion;
(reject reference to photosynthesis)
all plants given same light, so same rate of photosynthetic;
same temperature, so enzymes / named metabolic process at optimum temperature;
same named ion / minerals in soil(e.g. nitrate), so same available for a named function, (e.g. amino acid / protein synthesis);

2 max

(b) count cells using microscope;
count number of cells in cell division / where chromosomes visible;
and then the total number of cells in field of view;

2 max

(c) only cells at tip have ability to divide / cells further back don't divide;
cells further back differentiating / named example of
(accept reference to loss of totipotent cells)
differentiated tissue / too old / reduction in plant hormone;
cell wall too thick / vacuole too large to allow division;

2 max

(d) new cells added at tip;
cells increase in volume / larger;
increase in length (of cells);
as vacuole s get larger;
due to uptake of water (by osmosis);

3 max

[9]

Q11.

(a) 1. Gives rise to new plants / plantlets;

2. So must be able to develop into different tissues / other specialised cell types / differentiate;

1. Ignore references to leaves / callus

2

(b) Two marks for 5 : 1/50 : 10/1 : 0.2;;

One mark for ratio correctly identified but expressed incorrectly as 1 : 5 / 10 : 50 / 0.2 : 1;

2

(c) (i) 1. Meiosis / independent assortment / crossing over;

2. (Fusion of) genetically different gametes / random fertilisation;

2

(ii) Will be clones / produced by mitosis / will be genetically identical / less variation / all plants will have desired characteristics;

If the reference is to identical must be genetically identical, but allow less variation without the reference to genetical.

1

[7]

Q12.

(a) Decrease (woodlice turning in opposite direction to forced turn with increasing distance between turns) then more rapid decrease;

(Rapid decrease) when distance between turns is 9cm / 80% woodlice turning in opposite direction;

Accept 'after 9cm' or between 9 and 10cm' but not at 10cm

2

(b) No (no mark)

Equal numbers / 50% turn each way;

(Would expect this) by chance / at random;

2

(c) 1. Keep distance same;

2. Increase time / delay woodlice / decrease speed of woodlice

3. (Increase time) between forced and second turns;

Allow one mark for measure time taken for stated / set distance

3

(d) Short distances result in more (woodlice showing) turn alternation;

Keeps woodlice going in one direction / stops them going round in circles;

2

[9]

Q13.

(a) Time to establish humidity to that required / time for substance to absorb water;

So that behaviour typical of humidity;

Woodlice no longer affected by handling;

Allow acclimatisation idea

2 max

(b) Correlation does not show causal link;

May be due to other factors / named factor;

Do not accept casual

2 max

(c) 1. It is a line of best fit;

2. Variation in woodlice / a named difference in woodlice;

E.g. age, species, sex

3. Variation in environmental conditions / change in a named environmental condition;

E.g. Temperature / vibration / sound / light

3

[7]

Q14.

(a) 11.1;;

Allow one mark for calculating loss in mass as 0.02g and calculating a percentage;

Accept 11.11 / 11 but not 11.0

2

(b) 1. (More mass loss) linked to losing more water;

2. Gills (more) exposed to air / covered (less) by other woodlice so greater surface area (exposed);

3. (Not clumped) so lower humidity (around each woodlouse) so greater evaporation / diffusion (of water);

Assume 'They' refers to woodlice in group B

3

(c) Initial masses different;

1

[6]

Q15.

(a) (i) Taxis;

Ignore references to positive and negative, and prefixes such as photo-
Accept taxes / tactic
Allow phonetic spelling

1

(ii) Moves towards stimulus / towards light;

Direction must be correct.

1

(b) Gravity;

Antennae involved;

Doesn't show light is involved / doesn't respond to light as they are unable to see / as eyes are covered;

Accept geotaxis

3

(c) Helps them to leave the soil / ground / reach the surface;

Disperse / produce new colonies;

Avoid competition;

2 max

[7]

Q16.

Low humidity results in more woodlice moving;

So increased movement increased chance of leaving dry / unfavourable environment so reduce water loss / reduce evaporation;

[2]

Q17.

(a) (i) majority of larvae move to sectors on opposite side to lamp;
(reject largest number / most in sector 19)

1

(ii) use heat filter in front of lamp

(allow lamp not too close);

rotate card and lamp to eliminate magnetic field;
alter direction of larval head when releasing;
(reject general references to keeping variables constant)

1 max

(iii) wide beam from lamp;
variability of organisms;
positioning of larvae variable;

1 max

(b) idea of middle value;
method of determining middle value in rank order, e.g. sector in which 300 / 2 occurs;

2

[5]

Q18.

(a) Recognition of same species;

Stimulates release of gametes;

Recognition of mate / opposite gender;

Indication of sexual maturity / fertility;

2 max

(b) (i) Internal fertilisation / fertilisation occurs in pouch / limited area;

Q *The term fertilisation is not required in the answer but must be implied.*

1

(ii) Protection from predators (developing in pouch);

1

(c) (i) Less stress caused to seahorse / quicker / more accurate method / body is curved / head is linear;

Q *Do not accept "easier" unless qualified.*

1

(ii) Head length proportional to body length / or described;

1

(d) Positive correlation between head / body lengths of male and female / female and male with similar head / body lengths pair together;

1

(e) Use line of best fit;

And extrapolate / extend line as required;

2

(f) (Compare) DNA;

Sequence of bases / nucleotides;

Compare same / named protein;

Sequence of amino acids / primary structure;

Immunological evidence – not a mark

Inject (seahorse) protein / serum into animal;

(Obtain) antibodies / serum;

Add protein / serum / plasma from other (seahorse) species;

Amount of precipitate indicates relationship;

Q *The marks awarded for reference to DNA and sequence of bases / nucleotides must be in a different context to DNA hybridisation.*

6 max

[15]

Q19.

(a) kinesis;
(ignore 'ortho-' / 'klino-', allow 'thermo-', reject 'photo-' / 'chemo-' / etc)

random movements = 1 mark, eg
/ degree of turning / number of turns depends on strength of stimulus / on temperature / allow specific ref. to more turning at 35° than at 30° / non-directional stimulus / response;

ignore 'speed'

2

(b) stays longer in warmer area / at 35° / tends to leave cooler area / to leave 30° / stays in favourable conditions ;

remains near food source / on host;

2

[4]

Q20.

(i) kinesis;
movement is random / rate of turning changes / does not move towards / away from light;

2

(ii) advantage related to light / shade;
e.g. remains in shade so avoids predators

1

[3]

Q21.

(a) *one mark for conclusion:*
maggots move to / respond to / prefer / like / red rather than green;

(reject 'most prefer red')

maggots move to / prefer / like areas of lower light intensity (except green);

maggots respond more to colour than light intensity / do not respond to differences in light intensity;

(reject conclusion relating to single result)

one mark for:
evidence matching conclusion:
more in red than green, but light intensity the same;
more in segments with lower light intensity;
more differences in different colours, little difference in light intensity;
large difference in number of maggots on segments with 25 a.u. light intensity;

2 max

(b) valid statement expressed as null hypothesis, i.e. in negative form, e.g. no difference in response to different colours / light intensities;

(must relate to a possible hypothesis)

1

(c) rotate box (so segments in different direction) / change order of coloured segments;
place magnets around box / create alternative magnetic field;

1 max

[4]

Q22.

(a)
1. automatic (adjustments to changes in environment) / involuntary;
2. reducing / avoiding damage to tissues / prevents injury / named injury e.g. burning;
3. role in homeostasis / example;
4. posture / balance;
5. finding / obtaining food / mate / suitable conditions;
6. escape from predators;

(ignore 'danger' or 'harm' unless qualified)

3 max

(b) (i)
1. (impulse causes) calcium ions / Ca^{++} to enter axon;
2. vesicles move to / fuse with (presynaptic) membrane;
3. acetylcholine (released);
4. (acetylcholine) <u>diffuses</u> across synaptic cleft / synapse;
5. binds with receptors on (postsynaptic) membrane;

(reject active sites, disqualify point)

6. sodium ions / Na^{+} enter (postsynaptic) neurone;
7. depolarisation of (postsynaptic) membrane;
8. if above threshold nerve impulse / action potential produced

6 max

(ii) neurone to neurone and neurone to muscle;
action potential in neurone and no action potential in muscle / sarcolemma;
no summation in muscle;
muscle response always excitatory (never inhibitory);
<u>some</u> neuromuscular junctions have different neurotransmitters;

(penalise 'nerve' once)

2 max

[11]