

- M1.** (a) (i) Prevents sideways movement of IAA; 1
- (ii) Light does not destroy/change IAA;  
Diagram **D** shows total amount of IAA unchanged (by unilateral light);  
Light causes IAA to move to shaded side of shoot tip;  
Diagram **C** shows movement is in tip/not in agar block; 3 max
- (b) (i) Used in respiration / as energy source;  
*Q* Answers that refer to making energy should not be awarded credit. 1
- (ii) **Q** contains tip/site of IAA production;  
Addition of further IAA has little effect;  
*Q* Accept clear converse argument for **P** 2
- (iii) Inhibits (growth of) both in sucrose solution;  
Stimulates (growth of) both in sucrose and IAA solution;  
Greater effect in **P**; 3
- (c) (i) Uptake by active transport;  
(Evidence is that) heat-killed wild type has low/no uptake; 2
- (ii) Mutation increases number / frequency of proton/hydrogen ion pumps;  
(Which explains) increased uptake of IAA without DNP;  
DNP reduces uptake by mutant cells (to wild type value); 3
- [15]**
- M2.** (i) no (photo)receptor cells at **Y**/no rods and cones; 1
- (ii) **X** has many / only cones / more cones than **Z**;  
which each synapse to a single neurone / bipolar cell / no retinal convergence;  
*OR*  
**Z** has mainly rods/more rods than cones;  
which share/converge on neurones/bipolar cells; 2
- [3]**

- M3.** (a) no rods at blind spot or fovea;  
greater distribution of rods at edge; 2
- (b) more rods and no / fewer cones present;  
rods at the fovea / rods not mainly at periphery;  
  
rods have high sensitivity / show retinal convergence /  
converse for cones;  
  
rhodopsin 'bleached' at low light intensities / iodopsin 'bleached';  
at high light intensities; 3 max
- [5]
- M4.** (i) rhodopsin bleached/broken down by light;  
time for resynthesis; 2
- (ii) rhodopsin/pigment absorbs green light more readily than red / is  
more sensitive to green light;  
(after resynthesis) less (intense) green light needed to break down  
rhodopsin (than red); 2
- (iii) white has (high proportion of) wavelengths to which rhodopsin not  
sensitive; 1
- [5]
- M5.** (a) medulla; 1
- (b) **A** increase  
**B** increase; 1
- (c) it spreads through the atria / right atrium / through cardiac muscle;  
to the atrioventricular node;  
then through conduction fibres / bundle of His/Purkyne fibres); 3
- [5]
- M6.** (a) **B** – It is the 2<sup>nd</sup> contraction / occurs (immediately) after **A** / occurs  
after atrium;  
Larger / more force / more pressure; 2

(b) 
$$\frac{60}{\text{time for 1 cycle}}$$
  
 = 37 to 38  
*allow 1 mark if correct working shown*

max 2

- (c) (i) (Heart rate) reduced;  
 (Stroke volume) no effect;

2

- (ii) Reduced because  $\text{C.O.} = \text{H.R.} \times \text{S.V.}$  / connection argument based on reduced H.R.;

1

- (iii) Parasympathetic;

1

- (d) (i) 1. Coordination via medulla (of brain) / cardiac centre;  
 2. (Increased) impulses along sympathetic (/ cardiac accelerator) nerve;  
 3. To S.A. node / pacemaker;  
 4. Release of noradrenalin;  
 5. More impulses sent from / increased rate of discharge of S.A. node / pacemaker;

*Not "beats"; not "speeds up"*

6. Increased heart rate / increased stroke volume;

max 4

- (ii) In exercise – More energy release / more respiration / actively respiring muscles / for aerobic respiration;  
 Higher cardiac output – Increases O<sub>2</sub> supply (to muscles);

Increases glucose supply (to muscles);  
 Increases CO<sub>2</sub> removal (from muscles) /  
 lactate removal;  
 Increases heat removal (from muscles) /  
 for cooling;

*If no "increase" – max 2 marks*

3

[15]

- M7.** (a) 1. (Oxygen / carbon dioxide) detected by chemoreceptors / (pressure) detected by baroreceptors;
2. Medulla / cardiac centre involved;  
 2. *Accept a valid equivalent e.g. cardioacceleratory centre*
3. More impulses to SAN / along sympathetic nerve;  
 3. *Neutral: signals / messages*  
*Accept: acceleratory nerve*  
*Need idea of 'more impulses' directly, not by implication*

3

- (b) (i) 1. To ensure results are due to omega-3 / fatty acids (only) / not due to something else in the oil;  
*Neutral: Idea of comparing groups / results*
2. Placebo linked to mental / psychological effect;  
*Neutral: reference to a control group / placebo (unqualified)*
- 1 max
- (ii) 1. Lower / greater change of heart rate for Group A;  
*Ignore references to methodology*
2. (Differences) are real / reliable / significant / not due to chance;
3. As bars do not overlap / values are not shared;
- 3
- [7]
- M8.** (a) (i) 1 and 2 share neurone but 2 and 3 have separate neurones (to brain);  
*Ignore wrong names of neurones*
- 1
- (ii) 1 unit is sub-threshold / 3 units are above threshold / give sufficient depolarisation;  
(1 unit) No impulses / no action potential / in (sensory) neurone / does not stimulate (sensory) neurone / 3 units → impulses;  
(Spatial) summation / sufficient neurotransmitter released / from 3 receptors / insufficient N-T from one;  
*Reject 'temporal'*
- 3
- (b) (i) (Three) different types of (cone) cells / types 6 and 7 sensitive to different wavelengths / different frequencies / different colours;
- (ii) Impulses along separate neurone from each receptor cell / each receptor cell connects to separate neurone;
- 2
- [6]
- M9.** (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]

