

Mark schemes

Q1.

- (a) A = cornea 1
- B = lens 1
- C = optic nerve 1
- (b) by becoming thicker 1
- (c) ciliary muscles 1
- suspensory ligaments 1
- (d) retina  
*allow rods / cones / fovea* 1
- (e) retina  
brain  
muscles  
*in this order only*  
*3 correct = 2 marks*  
*1 or 2 correct = 1 mark* 2

[9]

Q2.

- (a) response / reaction  
*ignore examples*  
*ignore action* 1
- automatic or no thinking or not conscious or involuntary  
*ignore reference to brain*  
*ignore quick* 1
- (b) receptor (in skin of finger / hand) detects stimulus / temperature change  
*allow receptor detects heat ignore pain* 1

- (electrical) impulses pass along neurones  
*allow electrical signals pass  
along nerve cells  
ignore messages* 1
- (impulses pass from) sensory to relay to motor neurones 1
- synapse between neurones where chemical crosses gap  
*allow neurotransmitter / acetylcholine  
for chemical  
allow by diffusion* 1
- (synapses) in spinal cord / CNS  
*ignore brain* 1
- muscle contraction (to pull hand away)  
or effector is a muscle 1
- (c) coordination by endocrine system is:  
*allow converse points if clearly  
indicating nervous co-ordination  
answers must be comparative*
- slower 1
- longer-lasting 1
- (chemical / hormone) via blood instead of electrical / impulse / neurones 1
- (d) FSH (release from pituitary) stimulates maturation of egg / ovum / follicle  
*ignore reference to days of menstrual  
cycle  
allow FSH stimulates development /  
growth of egg* 1
- oestrogen (release from ovary) inhibits FSH production and stimulates LH production 1
- LH (release from pituitary) stimulates ovulation  
*allow LH stimulates release of egg* 1
- progesterone (release from ovary) inhibits FSH and LH production

*allow (release from corpus luteum)*

1

oestrogen and progesterone maintain the uterus lining

*allow oestrogen and progesterone build up the uterus lining*

1

[16]

Q3.

(a) (A) cerebellum

1

(B) pituitary gland

1

(C) cerebral cortex

1

(b) cerebellum

1

(c) coordinator

1

(d) neurone

*allow nerve (cell)  
ignore names of neurone*

1

(e) retina

1

(f) can see fruit / food

*allow can find fruit / food*

1

(so) get more food

1

(g) accommodation

1

(h) light rays are refracted less

1

(i) any one from: myopia

- short-sightedness
- 

*allow near-sightedness*

1

[12]

Q4.

- (a) A 1
- (b) cerebral cortex  
*allow cerebrum*  
*allow cerebral hemisphere(s)*  
*ignore D* 1
- (c) any three from:  
 • can ask people to do different tasks (while taking scan)  
*allow can ask person to do a (specific) task*  
 • to see which part of brain is active / inactive  
*allow to see which part of the brain is working*  
 • • • to compare with a person without brain damage  
 still to see (exactly) where the damage is  
 (traditional) MRI scanner cannot be used if people can't stay  
  
*allow examples such as children or patients with Parkinson's disease*  
*allow may be better for people who are claustrophobic* 3
- (d) (cells in) retina sensitive to light  
*allow retina detects light*  
*allow rods / cones detect light* 1
- impulse passes along (sensory) neurone  
*allow electrical signal or electrical message passes along (sensory) neurone* 1
- (along) optic nerve  
*allow chemical transmission across synapse* 1
- (e) 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

Indicative content

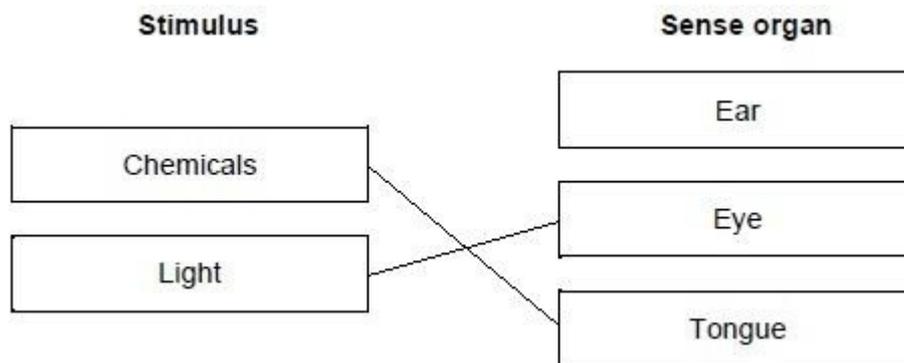
- mutation (in gene / DNA)
- randomly or due to chance
- causes new / different protein / (visual) pigment to be made in the retina of bird
- (so more) variation in the wavelengths of light birds retinas could detect
- birds with the mutation or birds able to detect UV are more likely to see fruits (that reflect UV)
- birds with the mutation or birds able to detect UV are more likely to see where small mammals are or have been
- therefore get more food (small mammals or fruit)
- avoid being eaten (by small mammals)
- out competing those birds without the mutation or birds not able to detect UV
- so more likely to survive and reproduce or have offspring
- by natural selection
- passing on allele / gene / mutation to offspring
- repeated over many generations
- 

For Level 3 a link to UV vision is required

[14]

Q5.

(a)



*additional lines from a stimulus negates the mark for that stimulus*

2

(b) any two from:

- fast / rapid
- protect (from danger / harm)
- a response / a reaction
- *ignore 'action'*
- automatic / involuntary or not under conscious control
- *allow not coordinated by conscious part*

1

1

*of the brain*  
 or  
*allow does not involve thought / thinking*  
*ignore not coordinated by the brain*

(c) the muscle contracts 1

(d) (10)  
 (14)  
 8 11  
 13

*in this order*  
*all 3 correct = 2 marks*  
*2 correct = 1 mark*  
*0 or 1 correct = 0 mark*

2

(e) (after drinking coffee) ruler falls less far (before being caught)  
*allow mean before = 17 and mean after = 11(.2)*  
*or mean after is only 11(.2)*  
*allow (ruler is) caught more quickly*

1

(f) any two from:

- more repeats
- test more students
- use ruler with more precise scale – e.g. mm scale
- *ignore accurate*
- drop from same height (above the hand)
- make sure student B's hand is stationary
- same distance between finger(s) and thumb

*allow alternative method – e.g. use of computer to measure reaction time*

2

[10]

Q6.

(a) ciliary muscles contract 1

(so ciliary muscles have a) smaller diameter 1

(so) suspensory ligaments loosen / slacken  
*do not accept 'relax'* 1

(so) lens thickens or lens becomes more curved / rounded  
*allow lens becomes fatter*  
*ignore lens becomes bigger* 1

- (thicker) lens is more convergent  
*allow light rays bent (inwards) more or light refracted more* 1
- light rays / image focused on retina  
*allow light rays meet on retina* 1
- (b) eye(-ball) is (too) short or lens cannot be thickened enough  
*allow ciliary muscles (too) weak or lens not (sufficiently) elastic* 1
- (so) light 'focuses' behind retina  
*allow (so) image forms behind retina* 1
- (c) convex / converging lens  
*allow shape described eg thicker in middle* 1
- light rays bent / refracted (inwards) more  
*allow changes direction of light rays further inwards* 1
- light rays focused on retina  
*allow light rays brought to a point on retina or light rays converge on retina or focused / clear image forms on retina* 1
- [11]
- Q7.
- (a) releasing saliva when food enters the mouth 1
- withdrawing the hand from a sharp object 1
- (b) bright light  
*allow described method of increasing light*  
*ignore light unqualified*  
*allow correctly named drug e.g. morphine / heroin* 1
- (c) iris 1
- (d) muscle contraction  
*allow muscles shorten*

*ignore radial / circular ignore muscles  
relax / constrict do not accept muscles  
expand do not accept ciliary muscle  
contracts*

- (e) Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. 1
- 4-6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1-3

No relevant content

0

Indicative content

- receptor detects stimulus
- e.g. receptor detects pressure
- receptor generates impulses / electrical signals
- neurones conduct impulses / electrical signals
- neurone A conducts impulses to spinal cord
- neurone A = sensory neurone
- synapse between neurones
- chemical (/ neurotransmitter) crosses synapse
- chemical stimulates impulse(s) in neurone B
- neurone B = relay neurone
- neurone C = motor neurone
- effector carries out response
- e.g. muscles of the arm / leg contract
- muscles contract or gland secretes chemicals

to access level 2, candidates need to consider, in terms of the indicative content, the receptor, the neurones and the effector in the correct sequence

[11]

Q8.

- (a) times are very short / in milliseconds  
or  
milliseconds cannot be  
measured with a stopwatch

1

- (b) to increase validity / repeatability  
or  
to get representative results

*allow to give a more reliable mean value*

1

because of variation in results

- allow to identify any anomalies* 1
- (c) (they have included) 468 / the 7th result  
*allow identification of anomaly in the table* 1  
 (which) is anomalous / is a much higher value (than the others) 1
- (d)  $\frac{275}{259}$   
 1.06 (: 1)  
*an answer of 1.06 (: 1) scores 2 marks* 1  
*allow max 1 mark if wrong number of sig. figs.* 1
- (e)  $2.59 \times 10^{-1}$  seconds 1
- (f) any two from:  
 • cannot compare mean to B as it has been incorrectly calculated  
 • C's mean reaction time is the longest, not the shortest  
 • only measured one type of reaction  
 or  
 • cannot generalise to all reaction types  
 • other factors can influence reaction time  
*allow examples* 2
- (g) involves (the conscious part of) the brain  
*allow voluntary (re)action* 1
- [11]

Q9.

- (a) any two from:  
 • drop the ruler from the same height  
 • use the same / dominant hand each time  
 • thumb same distance from ruler at the start  
 • use same type / weight of ruler  
 • drop the ruler without any force each time  
 • keep arm resting on the edge of the table 2
- (b) 8  
*allow 8.0* 1
- (c) 2 (in test number 2) 1
- (d) 12

- |     |  |      |
|-----|--|------|
|     |  | 1    |
| (e) | $(12 + 13 + 13 + 9 + 8 / 5 =) 11$                                | 1    |
| (f) | 0.15 – 0.12 (s)  | 1    |
|     | 0.03 (s)   | 1    |
|     | <i>allow 0.03 (s) with no working shown for 2 marks</i>          | 1    |
| (g) | carry out more repeats   | 1    |
| (h) | caffeine speeds up reflex actions<br>or<br>reduces reaction time | 1    |
|     |  | [10] |

Q10.

- |     |  |     |
|-----|--|-----|
|     |  |     |
| (a) | pupils dilated (at B)  |     |
|     | <i>allow converse for A</i>  | 1   |
|     | in dim light / low light levels  | 1   |
|     | because circular muscles (in iris) relax                                 | 1   |
|     | (and) radial muscles contract  | 1   |
| (b) | figure 2 shows myopia where light does not focus on the retina           |     |
|     | <i>allow refraction</i>  | 1   |
|     | in figure 3 the lens bends the light so that light focuses on the retina | 1   |
|     |  | [6] |

Q11.

- |     |   |  |
|-----|---|--|
|     |   |  |
| (a) | any two from:   |  |
|     | <ul style="list-style-type: none"> <li>• drop the ruler from the same height each time</li> <li>• let the ruler drop without using any force</li> <li>• same type / weight of ruler</li> <li>• thumb should be same distance from the ruler each time at the start</li> <li>• use the same hand to catch the ruler each time</li> <li>• carry out the experiment with the lower arm resting in the same way on the table</li> </ul> |  |
|     | <i>allow description of holding bottom edge of ruler opposite the catcher's thumb</i>   |  |

- |     |  |      |
|-----|--|------|
|     |  | 2    |
| (b) | 117  | 1    |
| (c) | $\frac{\sqrt{11.6}}{\sqrt{490}}$   | 1    |
|     | 0.1539   |      |
|     | <i>allow 01539 with no working shown for 2 marks</i>   | 1    |
|     | 0.154  |      |
|     | <i>allow 0.154 with no working shown for 3 marks</i>   |      |
|     | <i>allow ecf as appropriate</i>  | 1    |
| (d) | no indication beforehand when the colour will change<br>or<br>you might be able to tell when the person is about to drop the ruler | 1    |
|     | measurement of time is more precise (than reading from a ruler)<br>or<br>resolution (of computer timer) is higher                  | 1    |
| (e) | cerebral cortex<br><i>allow cerebrum</i><br><br><i>ignore identified lobes</i>   | 1    |
| (f) | cerebellum   | 1    |
|     |  | [10] |

Q12.

- |     |  |   |
|-----|--|---|
| (a) | (i) receptor cells   | 1 |
|     | (ii) eye(s)<br><i>accept retina</i>  | 1 |
| (b) | (i) any one from: <ul style="list-style-type: none"> <li>• gender / sex</li> <li>• quality of eyesight</li> <li>• <i>eg wearing glasses</i></li> </ul> <p>eg of factor that might affect reaction times</p> <p><i>eg alcohol consumption / distractions / tiredness / health / time of day / amount of practice (at this test)</i></p> |   |

- do not allow time / age* 1
- (ii) 182  
*allow 182.0* 1
- (iii) Any anomalies can be identified. 1
- (iv) reaction time (too) long or reactions (too) slow 1  
*allow reaction time (too) slow*  
*allow examples of data quoted or derived from the table, eg (mean) reaction time for 90 year olds is 162 ms longer than for 75 year olds*
- (so) more likely to have / cause an accident 1
- [7]

Q13.

- (a) receptors detect / sense stimuli / change in surroundings or convert stimulus into an impulse  
*ignore send impulses to brain / spinal cord* 1
- example of a receptor  
*allow any appropriate organ or part of an organ, eg eye / retina or named type of receptor eg light receptor* 1
- effectors allow / make response or convert an impulse to an action  
*ignore receive impulses from brain / spinal cord* 1
- (effector) muscle / gland  
*allow an example*  
*ignore eg arm / leg* 1
- (b) (i) junction  
*allow idea of a (small) gap / space*  
*do not allow if implication is that the neurones move* 1
- between neuron(e)s  
*allow named types of neurones* 1
- (ii) chemical

*allow answers in terms of specific types of neurone  
allow neurotransmitter / named neurotransmitter  
released*

1

any one from:

- (chemical released) from one neurone
- *ignore produced*  
(chemical) passes (across synapse) to next neurone to stimulate / cause (electrical) impulse  
*allow diffuses for passes (across)*

1

(c) (i) skin

*ignore hand / leg*

1

(ii) 1.6 (cm per millisecond)

*allow 2 if evidence of rounding up of 1.6*

1

(iii) any two from:

- *ignore length of neurones*  
synapses slow down transmission / impulse
- *allow idea of movement of chemical being slower*  
~~fewer synapses (via brain)~~  
*allow one synapse compared to two or only one*
- ~~synapse~~ (there) fewer delays

*allow impulse travels more slowly in relay neurones*

2

[12]