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 / <u>re</u>action

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
- to see (exactly) where the damage is
- (traditional) MRI scanner cannot be used if people can't stay still

  *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

0

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

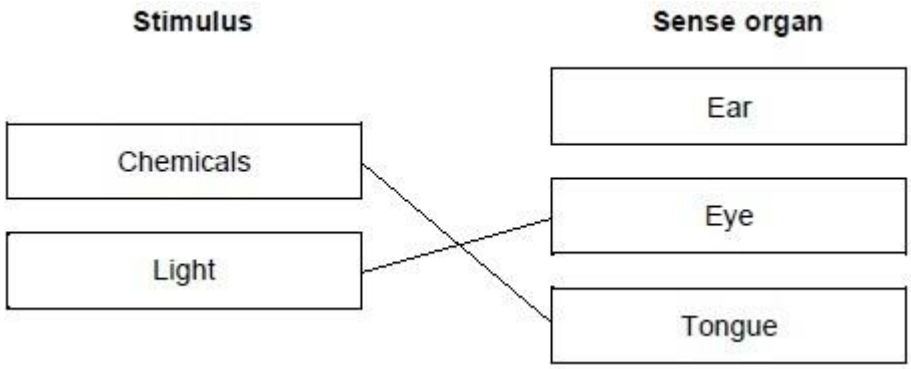
- so more likely to survive **and** reproduce **or** have offspring
- by natural selection
- passing on allele / gene / mutation to offspring
- repeated over many generations

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:

1

- fast / rapid
- protect (from danger / harm)

1

- a response / a reaction
  ignore 'action'
- automatic / involuntary **or** not under conscious control
  allow not coordinated by conscious part

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*

1

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

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) 2.59×10^{-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)

*allow 0.03 (s) with no working shown for **2** marks*

1

(g) carry out more repeats

1

(h) caffeine speeds up reflex actions
or
reduces reaction time

1

[10]

Q10.

(a) pupils dilated (at **B**)

*allow converse for **A***

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

allow refraction

1

in figure 3 the lens bends the light so that light focuses on the retina

1

[6]

Q11.

(a) any **two** from:

- drop the ruler from the same height each time
- let the ruler drop without using any force
- same type / weight of ruler
- thumb should be same distance from the ruler each time at the start
- use the same hand to catch the ruler each time
- carry out the experiment with the lower arm resting in the same way on the table

allow description of holding bottom edge of ruler opposite the catcher's thumb

2

(b) 117

1

(c) $\sqrt{\frac{11.6}{490}}$

1

0.1539

*allow 01539 with no working shown for **2** marks*

1

0.154

*allow 0.154 with no working shown for **3** marks*

1

allow ecf as appropriate

(d) no indication beforehand when the colour will change
or
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)
or
resolution (of computer timer) is higher

1

(e) cerebral cortex

allow cerebrum

1

ignore identified lobes

(f) cerebellum

1

[10]

Q12.

(a) (i) receptor cells

1

(ii) eye(s)

accept retina

1

(b) (i) any **one** from:

- gender / sex
- quality of eyesight
  eg wearing glasses
- eg of factor that might affect reaction times
  eg alcohol consumption / distractions / tiredness / health / time of day / amount of practice (at this test)

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 than electrical impulse
- fewer synapses (via brain)
  *allow one synapse compared to two **or** only one synapse*
- (therefore) fewer delays
  allow impulse travels more slowly in relay neurones

2

[12]