Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Coordination and response

Time allowed: 1 hour 30 minutes

Subject code **0610**

Biology

Questions from Paper 3, Paper 4 and Paper 6

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 89

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 89 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

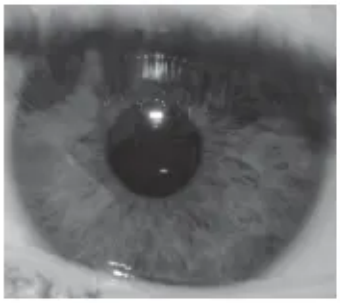
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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Fig. 3.1 shows two photographs of a person's eye.

In photograph **A** the person was looking out of a window.

In photograph **B** the person had turned away from the window.



A



B

Fig 3.1

(a) Describe what happened to the diameter of the pupil in photograph **B**.

..... [1]

(b) Explain your observation.

.....

.....

.....

.....

..... [2]

[Total: 3]

Sense organs and the eye Click for more variations

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1 (a)	increases / dilates / AW; **[1]**	
(b)	Low(er) intensity / less light (enters eye) / to get more light into the eye / AW; Circular muscles (of iris) relax / lengthen; Radial muscles contract / shorten; **MAX [2]**	**Accept** room is darker **Ignore** references to ciliary / longitudinal muscles **Ignore** descriptions of reactions to full light / photograph A
	[Total: 3]	

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2 **(a)** Define the term sense organ.

.....

.....

.....

.....

..... [2]

(b) Fig. 9.1 is a diagram of a section of a human eye.

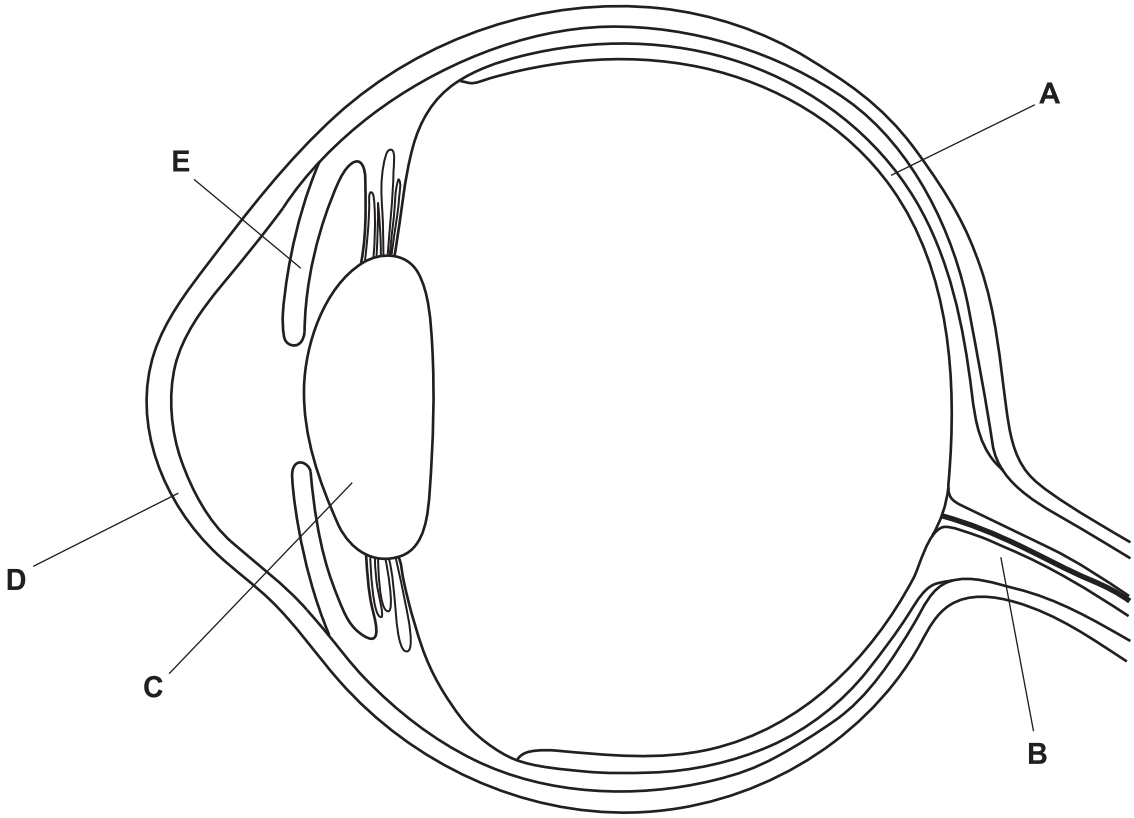


Fig. 9.1

State the letter of the structure shown on Fig. 9.1 that:

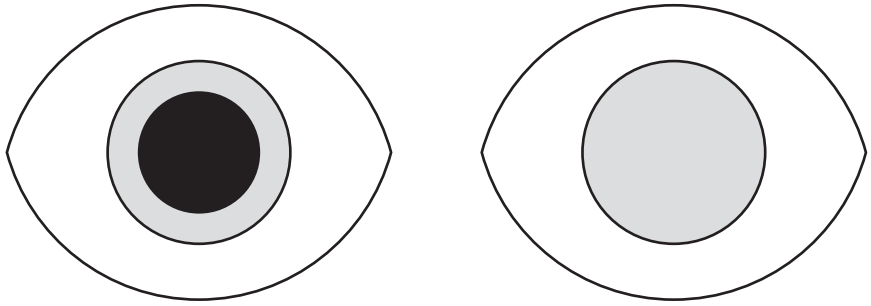
- focuses light on the light receptors .....
- refracts light .....
- controls how much light enters the pupil .....
- carries impulses to the brain .....

[4]

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(c) Fig. 9.2 is a diagram of an eye in a dark room and in a light room.

Draw the expected size of the pupil on the eye in the **light room** in Fig. 9.2.



dark room light room

Fig. 9.2

[1]

[Total: 7]

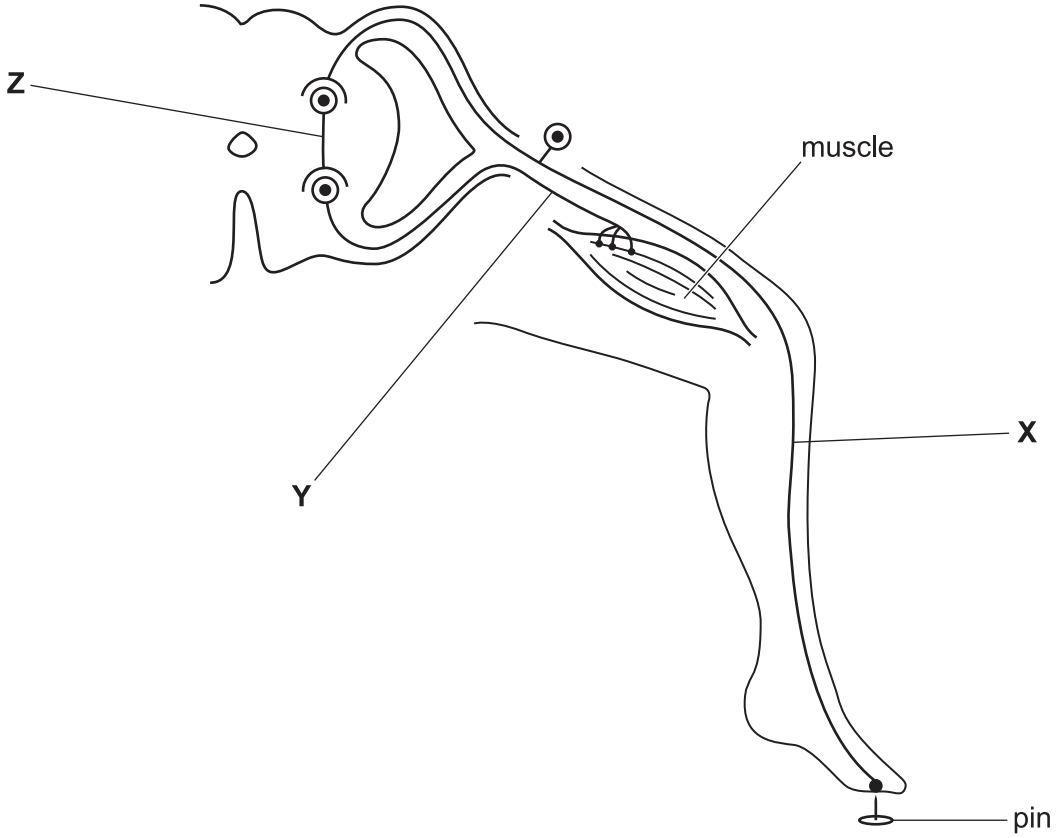
Sense organs and the eye Click for more variations

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2(a)	groups of receptor cells ; responding to specific stimuli ;	**2**	
2(b)	**C** ; **D** ; **E** ; **B** ;	**4**	
2(c)	a circle drawn in the iris that is smaller than the pupil in the dark room diagram ;	**1**	

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3 **(a)** Fig. 7.1 shows the reflex arc that is involved when someone steps on a pin.



not to scale

Fig. 7.1

(i) The skin is a sense organ and can detect the pin.

State the type of stimulus that the cells in the skin are responding to.

..... [1]

(ii) Describe the reflex action shown in Fig. 7.1.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(b) The response of the pupil to changes in light intensity is also an example of a reflex action.

(i) Fig. 7.2 shows the size of the pupil in dim light.

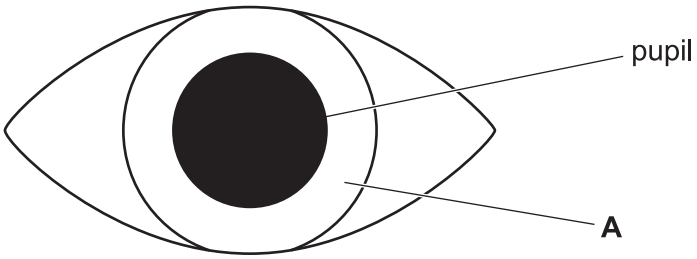


Fig. 7.2

On Fig. 7.3, draw the expected appearance of the pupil in bright light.

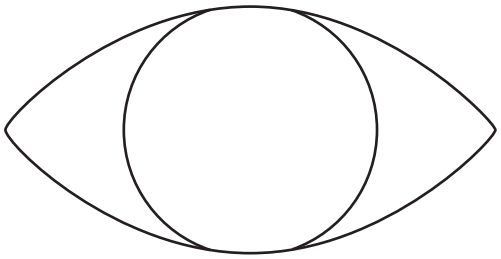


Fig. 7.3

[1]

(ii) State the name of the structure labelled **A** in Fig. 7.2.

..... [1]

(iii) State the name of the tissue in the eye that detects light.

..... [1]

[Total: 8]

Nervous system, neurones and reflexes Click for more variations

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3(a)(i)	touch ;	**1**	**A** pain / pressure
3(a)(ii)	*any four from:* X is sensory (neurone), Y is motor (neurone), Z is relay (neurone) ; (pin is detected) by a receptor ; ref. to electrical impulse ; (impulse travels) from X to Z to Y ; ref. to synapse ; (impulse to,) effector ; effector / muscle (contracts), moves foot off the pin ;	**4**	
3(b)(i)	pupil drawn smaller than in Fig. 7.2 ;	**1**	
3(b)(ii)	iris ;	**1**	
3(b)(iii)	retina ;	**1**	

STEM | Exam Builder

4 Reflex actions play an important part in human behaviour.

(a) **(i)** What is meant by the term *reflex action*?

.....

.....

.....

.....

.....[2]

(ii) Suggest why reflex actions are important.

.....

.....[1]

(b) A reflex arc is made up of a number of different parts.

Complete the sentences that describe a reflex arc by writing the correct words in the spaces.

Each word may be used once, more than once or not at all.

brain **effector** **motor neurone** **receptors**
relay neurone **sensory neurone**

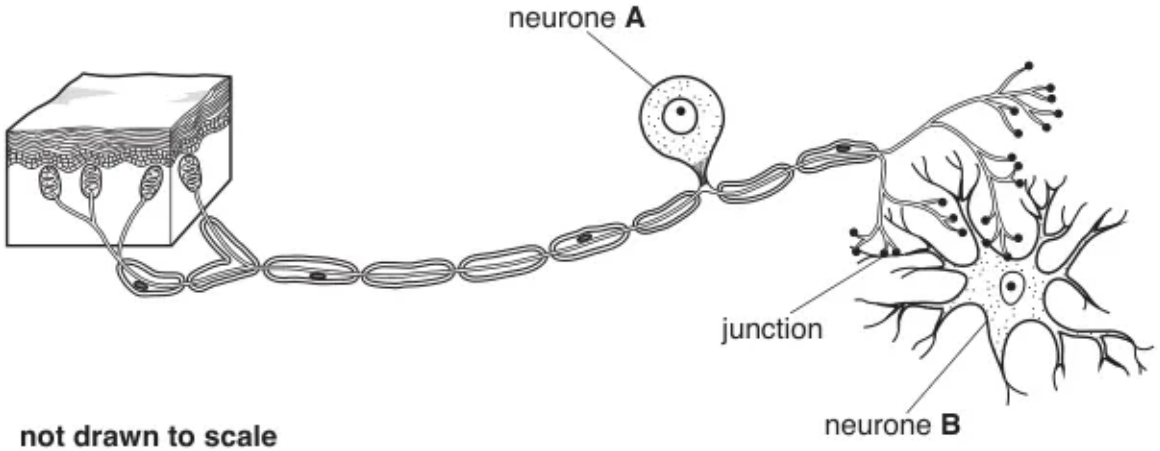
Changes in the surroundings are detected by ..... which generate an impulse in a ..... . Nerve impulses travel from this cell to a ..... . The impulses then travel to a ..... . Finally the nerve impulse is passed to an ..... which results in the body responding to the changes. [4]

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(c) Fig. 6.1 is a diagram of a reflex arc.

It shows two different neurones.

These are labelled neurone **A** and neurone **B**.



not drawn to scale

Fig. 6.1

(i) There are small gaps at the junctions between neurone **A** and neurone **B**.

State the name of these gaps.

.....[1]

(ii) State where in the body neurone **B** can be found.

.....[1]

[Total: 9]

Nervous system, neurones and reflexes Click for more variations

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4(a)(i)	*any two from:* automatic / involuntary (response) /AW; fast / immediate / sudden (response); same response; integrates / co-ordinates, stimuli and responses;	**2**	**A** unconsciously / without thinking
4(a)(ii)	*idea* that responses are protective / needed for survival / keep safe / avoid getting hurt / AW;	**1**	
4(b)	receptors; sensory neurone; relay neurone; motor neurone; effectors;	**4**	All correct = 4 3 or 4 correct = 3 2 correct = 2 1 correct = 1
4(c)(i)	synapse;	**1**	
4(c)(ii)	spinal cord / CNS / brain;	**1**	
		Total: 9	

STEM Exam Builder

5 Sensitivity is one of the characteristics of all living organisms.

(a) Define the term *sensitivity*.

.....

.....

..... [2]

(b) The eye is an example of a sense organ.

(i) Define the term *sense organ*.

.....

.....

..... [2]

(ii) Adrenaline is a hormone that is released in 'fight or flight' situations. It causes a change in the eye.

Complete Table 6.1 by stating the parts of the eye that change when adrenaline is released into the blood.

Table 6.1

action	part of the eye
muscle that relaxes	
muscle that contracts	
widens	

[3]

[Total: 7]

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Characteristics of living organisms Click for more variations

5(a)	(the ability to) detect stimuli (in the internal / external environment) ; to make (appropriate) responses ;	**2**	
5(b)(i)	groups of receptor cells ; responding to specific stimuli ;	**2**	
5(b)(ii)	<table><tr><td>action</td><td>structure</td></tr><tr><td>relaxes</td><td>circular muscles (of the iris) ;</td></tr><tr><td>contracts</td><td>radial muscles (of the iris) ;</td></tr><tr><td>widens</td><td>pupil ;</td></tr></table>	**3**	

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6 Two identical potted plants were used to investigate plant responses.

Plant **A** was placed on a clinostat that continually rotated. Plant **B** was not rotated.

Both plants were then placed on their sides and kept in the dark.

Fig. 4.1 shows the two plants at the start of the experiment and after seven days.

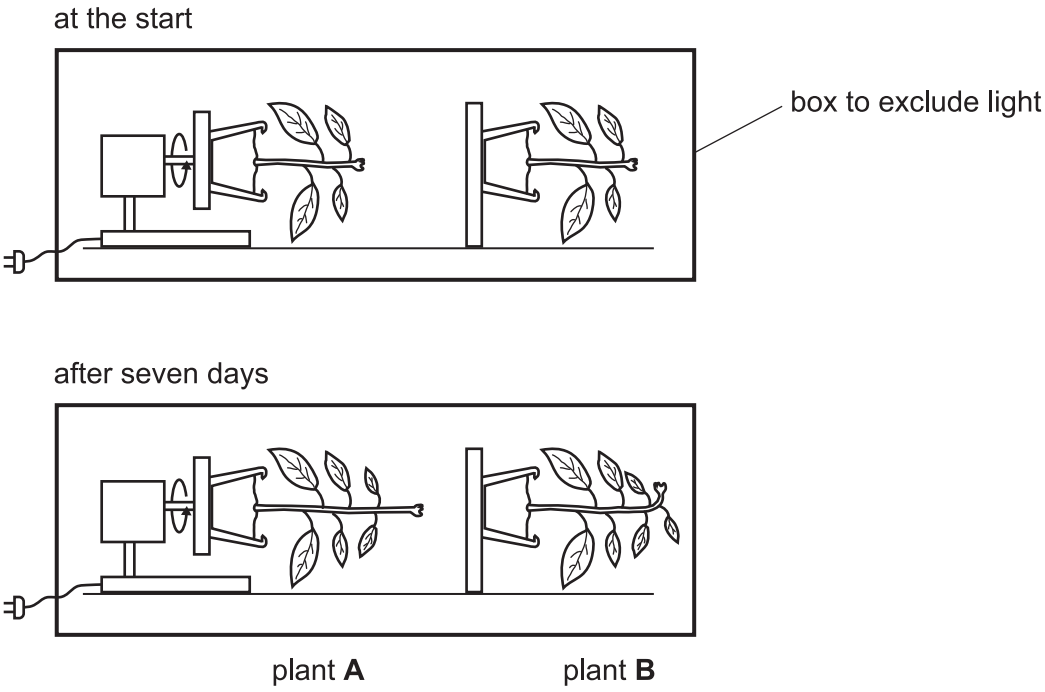


Fig. 4.1

(a) State the name of the response shown by the shoot of plant **B**.

..... [1]

(b) Explain the reason for constantly rotating plant **A**.

.....

.....

.....

.....

..... [2]

(c) **(i)** State the name of the plant hormone that causes the response of the shoot of plant **B**.

..... [1]

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(ii) Explain how the plant hormone causes the response of plant **B**.

.....

.....

.....

.....

.....

.....

..... [3]

(d) Seeds germinate in the soil. The seedlings that grow from seeds show the same response as shown by plant **B** in Fig. 4.1.

Explain the advantages of this response to the survival of seedlings and mature plants.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

Tropic responses Click for more variations

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6(a)	gravitropism ;	**1**	
6(b)	*idea of* negating the effect of gravitational pull / gravity, on one side of the plant (only) ; (used as a control) to compare with (the response of) plant **B** ;	**2**	

6(c)(i)	auxin ;	**1**	
6(c)(ii)	*any three from:* *(auxin / hormone produced in the tip)* moves / diffuses, away from tip / down the, stem *or* shoot *or* plant ; moves to / collects on, one / lower side (of stem / plant) ; stimulates cell elongation ; stem / plant, bends / grows / turns, upwards ; AVP ;	**3**	
6(d)	*any three from:* reach light for photosynthesis ; (reach air for) carbon dioxide for photosynthesis ; (reach air for) oxygen for respiration ; *idea that they* grow tall so that flowers are exposed for, (wind / insect) pollination ; AVPs e.g. roots grow downwards / towards (direction of) gravity ; to reach, water / ions *or* minerals ; to anchor plant in the soil ;	**3**	

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7 The light sensitive cells in the eye are known as rods and cones.

Fig. 2.1 shows drawings of a rod cell and a cone cell.

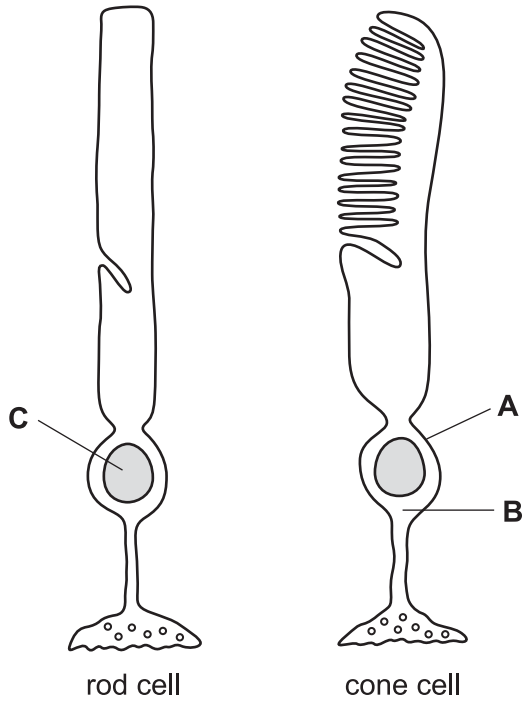


Fig. 2.1

(a) Name the structures labelled **A** to **C**.

A .....

B .....

C ..... [3]

(b) **(i)** Name the tissue in the eye where rods and cones are found.

..... [1]

(ii) Name the parts of this tissue where there are

cones but no rods .....

no cones or rods ..... [2]

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(c) Describe how rods and cones function.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 10]

Sense organs and the eye Click for more variations

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7 **(a)**	**A** cell membrane ; **B** cytoplasm ; **C** nucleus	[3]	
(b) (i)	retina ;	[1]	
(ii)	fovea / yellow spot ; blind spot / optic disc / end of optic nerve ;	[2]	

(c)	**1**	light absorbed (by a pigment) ;		
	2	rods detect low light (intensity) ;		
	3	give 'black and white' vision / do not detect colour ;		
	4	provide night vision / AW ;		
	5	cones detect high light (intensity) ;		
	6	cones detect colour ;		
	7	any detail, e.g. three different types of cone ;		
	8	convert light into (electrical) impulses ;		
	9	impulses sent to brain ;		
	10	via, neurones / sensory nerve / optic nerve ;	[max 4]	
			[Total: 10]	

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8 **(a)** Movement is a characteristic of living organisms.

Define the term *movement.*

.....

..... [1]

When the hand is stimulated by a hot object a reflex action occurs in which the fore-arm is raised.

Fig. 2.1 shows the muscles and the neurones involved in the reflex action.

The arrows show where there are nerve impulses during the reflex action.

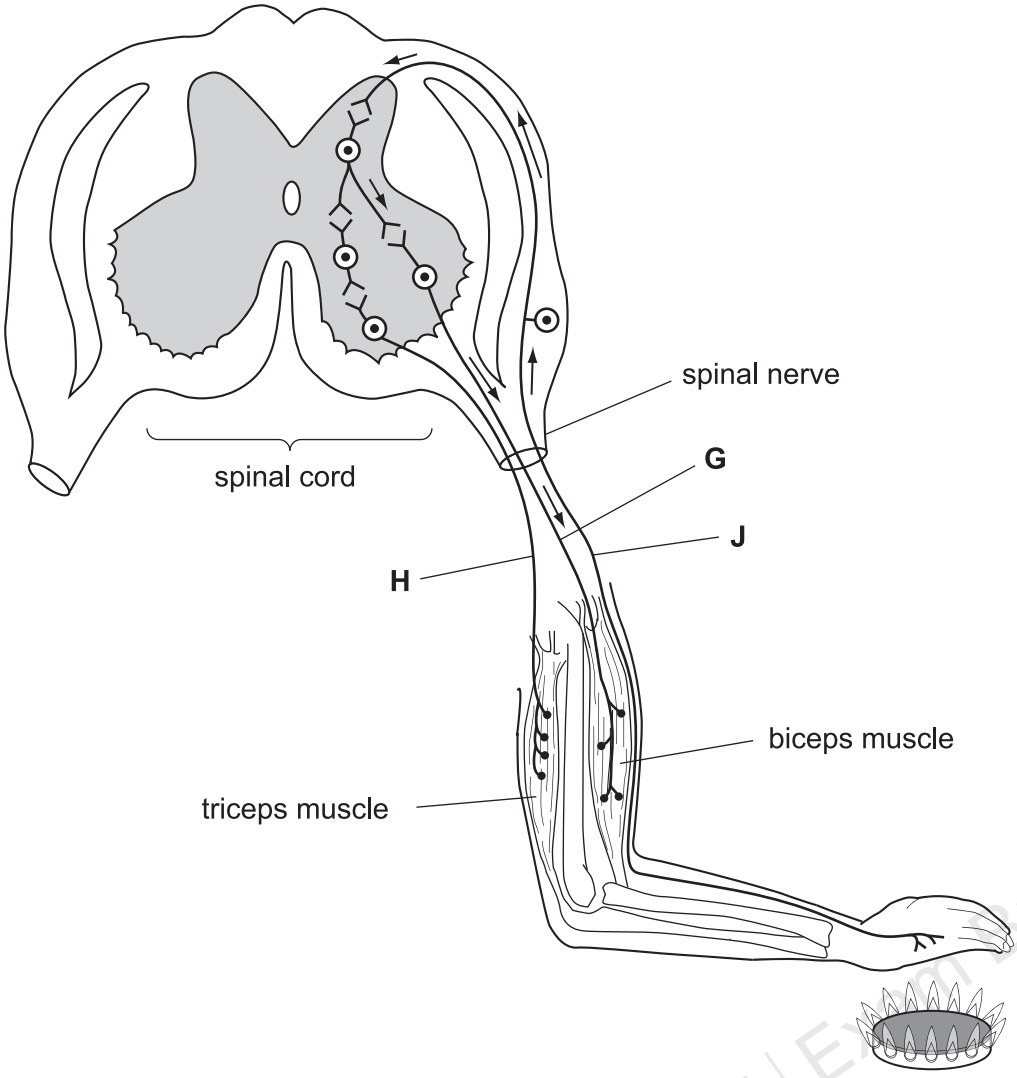


Fig. 2.1

(b) (i) State the name for the action of two opposing muscles, such as the biceps and the triceps.

..... [1]

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(ii) Explain how two opposing muscles bring about movement at the elbow joint.

.....

.....

.....

.....

.....

.....

..... [3]

(c) (i) Describe the function of neurone **J**.

.....

.....

.....

..... [2]

(ii) Explain why there are impulses in motor neurone **G**, but not in motor neurone **H**.

.....

.....

.....

.....

..... [2]

(d) The action shown in Fig. 2.1 is an involuntary reflex action. The muscles can also be used for voluntary actions.

Explain how muscles are controlled during voluntary actions.

.....

.....

.....

.....

..... [2]

[Total: 11]

Nervous system, neurones and reflexes Click for more variations

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8	**(a)**		*whole / part of, organism* changes in position / changes in place ;	[1]	***ignore*** locomotion **A** (moves) from place to place / one place to another
	(b)	**(i)**	antagonistic ;	[1]	**A** antagonism
		(ii)	*idea of* muscle pull (don't push) ; biceps contracts ; triceps relaxes ; flexion / described as movement of (fore)arm ; during relaxation muscle is, stretched / passive ; both contract to maintain position / holding an object ;	[max 3]	*assume answer is about flexion – credit ora for extension – mark through if both given* if answer does not mention the names of the muscles but has the right idea for one contracts and the other relaxes, then allow one mark for MP2+3 contraction and relaxation of the pair must be linked to the correct movement of the arm. If not, no marks **R** hand **A** named correct bone – radius and/or ulna **A** lengthens
	(c)	**(i)**	*transmits impulses* from, receptor / nerve endings / sensory endings / skin / sensory organ ; to, CNS / spinal cord / connector neurone / relay neurone ;	[2]	***ignore*** sensory neurone as question says 'describe' ***ignore*** 'messages' / 'signals' / 'senses the stimulus' **R** 'fingers' / 'hand' **A** interneurone **R** 'brain' / 'brain and spinal cord'
		(ii)	*idea that* impulses stimulate muscle to, contract / move hand ; (only) biceps contracts (to raise the forearm) ; ref. to impulse does not cross synapse to **H** ;	[2 max]	*assume answer is about neurone G, but accept about H*
	(d)	**1** **2** **3** **4**	many / different, stimuli ; brain, decides / controls / coordinates ; impulses in motor, neurones / nerves ; to, (many) muscles / effectors (involved) ;	[max 2]	**R** if one muscle
				[Total: 11]	

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9 **(a)** Complete the sentence about the mammalian nervous system.

The ..... nervous system consists of the brain and spinal cord and the ..... nervous system consists of the nerves outside the brain and spinal cord.

[1]

(b) Fig. 4.1 shows the parts of a reflex arc.

M	effector
N	motor neurone
P	receptor cell
Q	relay neurone
R	response
S	sensory neurone
T	stimulus

Fig. 4.1

(i) Put the parts listed in Fig. 4.1 into the correct sequence, and write the letters in the boxes.

Two have been done for you.

T						**R**

[2]

(ii) State **two** stimuli that are detected by the skin.

1 .....

2 .....

[2]

(iii) The pupil reflex controls the amount of light that enters the eye.

State the name of an effector in the pupil reflex.

..... [1]

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(c) Describe and explain how impulses are **only** passed in one direction from one neurone to the next.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 11]

Nervous system, neurones and reflexes Click for more variations

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9(a)	*first gap:* central **and** *second gap:* peripheral **;**	**1**	both needed for the mark
9(b)(i)	**T** **P** **S** **Q** **N** **M** **R** **;;**	**2**	MP1 for **P** first and **M** at the end MP2 for **S**, **Q**, **N** in that order but in *any* position in relation to **P** and **M**
9(b)(ii)	*any two from:* touch **;** temperature **;** AVP **;**	**2**	e.g. pressure / pain
9(b)(iii)	circular / radial, muscle **;**	**1**	**A** iris
9(c)	*total of five from:* **1** only the first neurone releases neurotransmitters **;** ***2*** only the second neurone has (complementary) receptors **;** *max four from:* **3** *ref. to* neurotransmitter (molecules) **;** **4** (neurotransmitter is released) from vesicles **;** **5** into the synaptic gap **;** **6** the junction between the neurones is the synapse **;** **7** (neurotransmitter molecules) diffuse (across the gap) **;** **8** *ref. to* receptors are complementary in shape (to neurotransmitter) **;** **9** (neurotransmitter molecules) bind with receptors (on the next neurone) **;** **10** impulse is then stimulated (in the next neurone) **;**	**5**	

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10 Fig. 3.1 is a diagram of the junction between two neurones in a healthy person.

Fig. 3.2 is a diagram of the junction between the same two neurones in a person who has Parkinson's disease. This disease affects the nervous system.

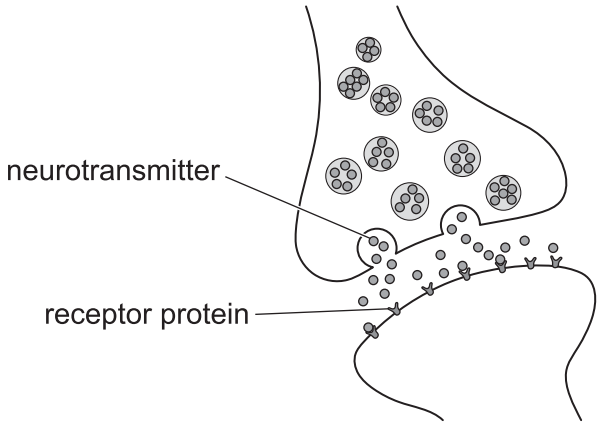


Fig. 3.1

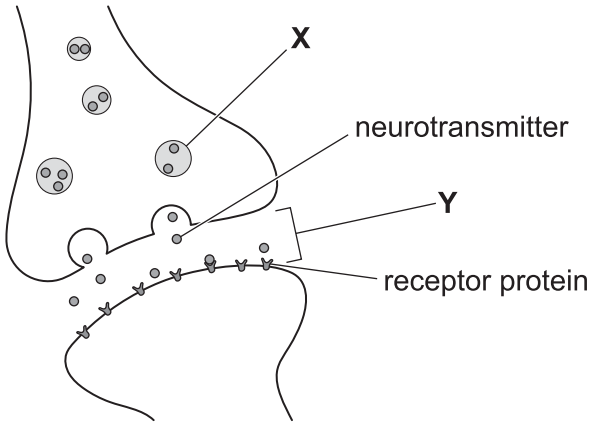


Fig. 3.2

(a) Identify the parts labelled **X** and **Y** in Fig. 3.2.

X .....

Y .....

[2]

(b) Parkinson's disease affects neurones in the brain that are responsible for movement.

Using the information in Fig. 3.1 and Fig. 3.2, suggest **and** explain the effect of Parkinson's disease on a person's movement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

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(c) Describe **two** ways nervous control differs from hormonal control.

1 .....

.....

2 .....

.....

[2]

(d) **(i)** The shape of the receptor proteins shown in Fig. 3.1 and Fig. 3.2 is important for their function.

Explain how the shape of the receptor proteins is determined.

.....

.....

.....

.....

..... [2]

(ii) Cell membranes also contain protein carriers. Describe the role of protein carriers.

.....

.....

.....

.....

..... [2]

[Total: 13]

Nervous system, neurones and reflexes Click for more variations

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10(a)	**X** – vesicle (membrane) **;** **Y** – synapse / synaptic gap **;**	**2**	
10(b)	*any five from:* movement is, impaired / slower / non-existent **;** slower reflexes / AW **;** fewer vesicles **;** fewer neurotransmitters in, vesicles / **X** **;** fewer neurotransmitters, released (when an impulse arrives) **;** fewer neurotransmitters diffuse across the, synapse / gap / cleft **;** fewer neurotransmitters bind to receptor proteins **;** fewer / no, impulses (in the, postsynaptic / second / next, neurone) **;** AVP **;**	**5**	
10(c)	*any two from:* more rapid **;** short-lived effect **;** localised / AW **;** transmission of (electrical) impulses **;** (transmission is through) neurones / nerve cells **;**	**2**	**A** ora for hormonal control throughout, i.e.: slower (some may have) long-lasting effect widespread / AW hormones are chemicals transmission through the, blood / circulatory, system
10(d)(i)	*any two from:* sequence of bases in, gene / DNA / mRNA, determines sequence of amino acids **;** sequence of amino acids determines shape of receptor proteins **;**	**2**	
10(d)(ii)	move / carry, (named) molecules / ions, across membrane(s) / into *or* out of cells **;** by active transport / using energy from respiration **;** movement against concentration gradient / from low to high concentration **;**	**2**	

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