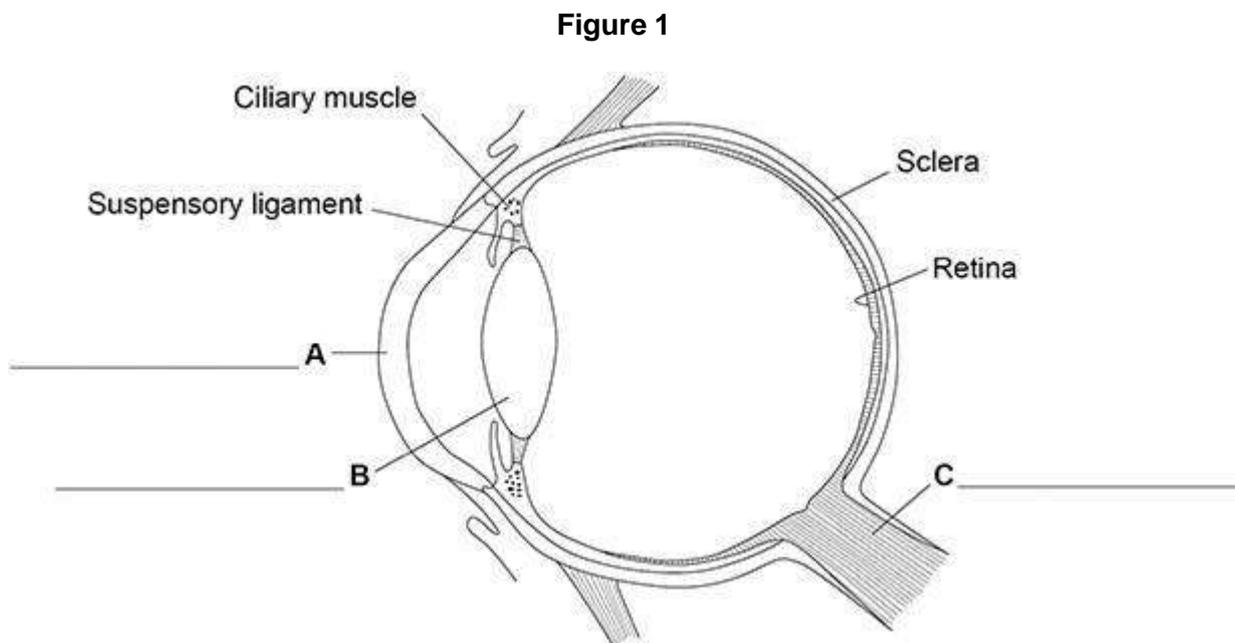




Q1.

The human eye can form images of objects that are at different distances away from the eye.

Figure 1 is a diagram of the eye.



(a) Label structures **A**, **B** and **C** on **Figure 1**.

Choose answers from the box.

| | | | | |
|--------|--------|------|------|-------------|
| cornea | eyelid | iris | lens | optic nerve |
|--------|--------|------|------|-------------|

(3)

The eye in **Figure 1** is focused on a distant object.

If the eye then focuses on the words in a book, changes would occur in the eye.

The light rays would be refracted more by the lens.

(b) How does the lens refract the light more?

Tick (✓) **one** box.

By becoming longer

By becoming thicker



By becoming transparent

(1)

(c) Which **two** structures control the shape of the lens?

Tick (✓) **two** boxes.

Ciliary muscles

Cornea

Iris

Sclera

Suspensory ligaments

(2)

(d) To form a clear image, the light rays entering the eye must focus on one structure in the eye.

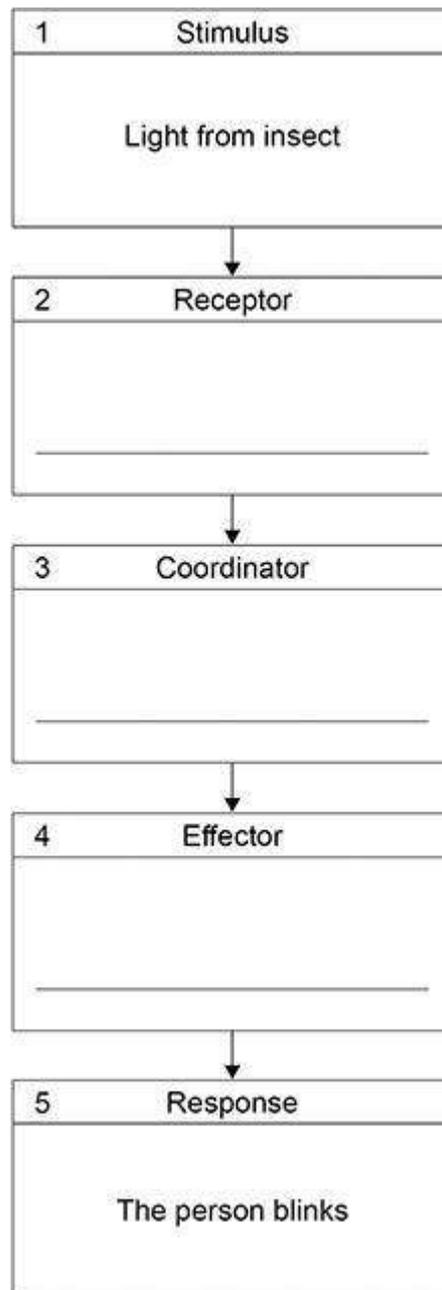
Name the structure.

(1)

(e) An insect flies near a person's eye. The person blinks. This is a reflex action.

Figure 2 shows the coordination system for this reflex action.

Figure 2



Complete **Figure 2**.

Choose answers from the box below.

Write **one** word in each of boxes **2**, **3** and **4** of **Figure 2**.

| | | | | |
|-------|--------|------|---------|--------|
| brain | cornea | iris | muscles | retina |
|-------|--------|------|---------|--------|

(2)
(Total 9 marks)

Q2.

Reflex actions are coordinated by the nervous system.



(3)

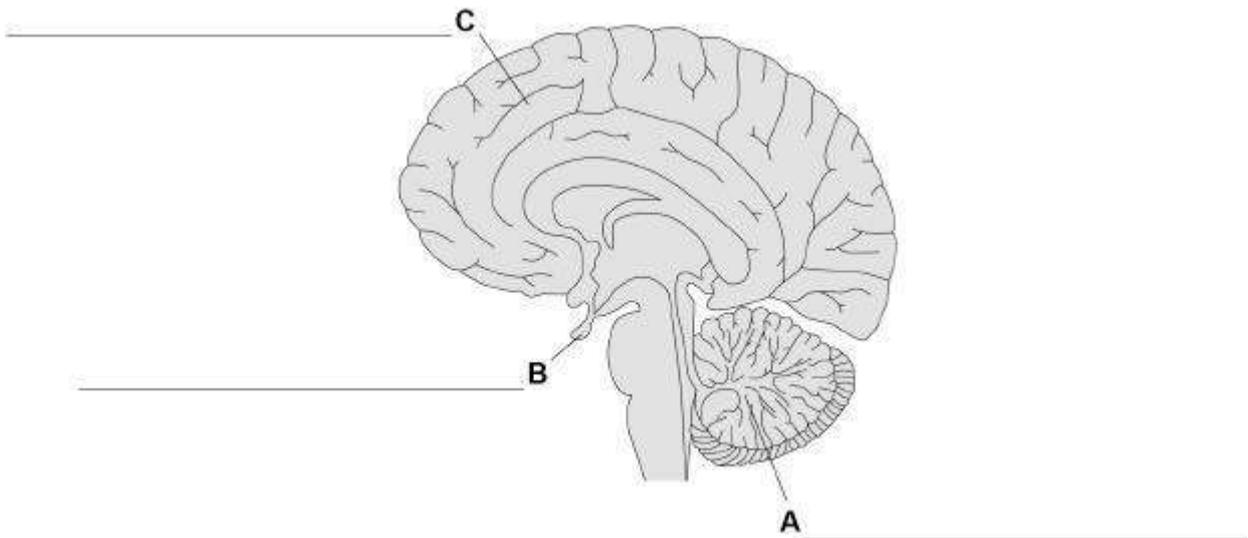
(d) Describe how hormones control the menstrual cycle.

(5)

(Total 16 marks)

Q3.

The diagram below shows the brain.





(a) Label **A**, **B** and **C** on the diagram above.

Choose answers from the box.

| | | | |
|------------|-----------------|---------|-----------------|
| cerebellum | cerebral cortex | medulla | pituitary gland |
|------------|-----------------|---------|-----------------|

(3)

(b) Which part of the brain controls balance when riding a bicycle?

Tick (✓) **one** box.

| | |
|-----------------|--------------------------|
| Cerebellum | <input type="checkbox"/> |
| Medulla | <input type="checkbox"/> |
| Pituitary gland | <input type="checkbox"/> |

(1)

(c) The ears send information about sound to the brain.

Which word describes the brain?

Tick (✓) **one** box.

| | |
|-------------|--------------------------|
| Coordinator | <input type="checkbox"/> |
| Effector | <input type="checkbox"/> |
| Receptor | <input type="checkbox"/> |
| Stimulus | <input type="checkbox"/> |

(1)

(d) What type of cell carries impulses from the ears to the brain?

(1)

(e) Human eyes detect light.

Which part of the eye has cells that detect light?

Tick (✓) **one** box.



| | |
|--------|--------------------------|
| Iris | <input type="checkbox"/> |
| Lens | <input type="checkbox"/> |
| Retina | <input type="checkbox"/> |

(1)

- (f) The eyes of some birds have specialised cells to detect ultraviolet (UV) light.

Some fruits reflect UV light.

Explain why it is an advantage for birds to be able to detect UV light.

(2)

The image below shows a student reading a book.



There are trees on the far side of the field.

The student looks at the trees instead of looking at the book.



(g) What process occurs in the eye when the student looks at the trees instead of looking at the book?

Tick (✓) **one** box.

Accommodation

Magnification

Reflection

(1)

(h) What change happens in the student's eyes when they look up at the trees?

Tick (✓) **one** box.

Light rays are refracted less

More light is reflected

The optic nerves move

(1)

(i) The student **cannot** see the trees in focus.

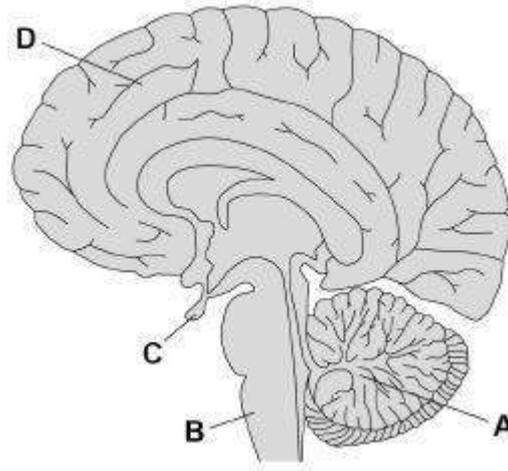
Name the common defect of the eye which causes distant objects to appear out of focus.

(1)

(Total 12 marks)

Q4.

The diagram below shows the brain.



- (a) Which part of the brain becomes more active if a person balances on one leg instead of standing on two legs?

Tick (✓) **one** box.

A B C D

(1)

- (b) Name the part of the brain that is responsible for making a decision.

(1)

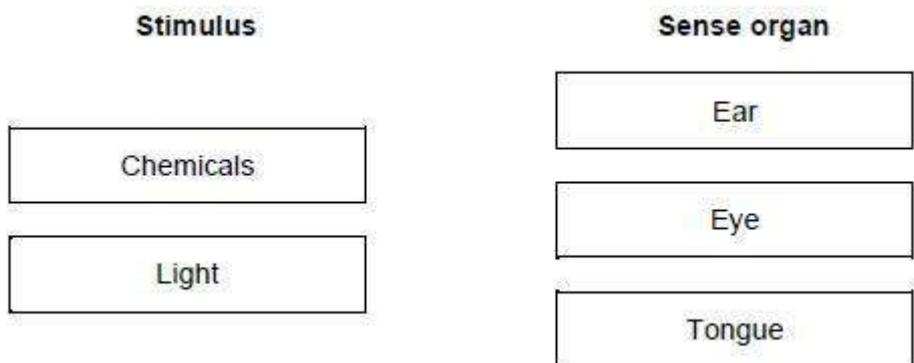
- (c) In most MRI scanners the person being scanned needs to stay completely still.

A functional MRI (fMRI) scanner allows a person to move while the scanner makes images of the person's brain activity.

Suggest how the fMRI scanner could help to find out more about the brain damage a person has.

(3)

- (d) Describe how the brain receives information about light entering the eye.



(2)

Moving a hand away from a hot object is an example of a reflex action.

(b) What is a reflex action?

(2)

(c) A muscle in the arm moves the hand away from the hot object.

How does the arm muscle do this?

Tick (✓) **one** box.

- The muscle contracts.
- The muscle expands.
- The muscle relaxes.
- The muscle shrinks.

(1)

Two students investigated the effect of drinking coffee on reaction time.

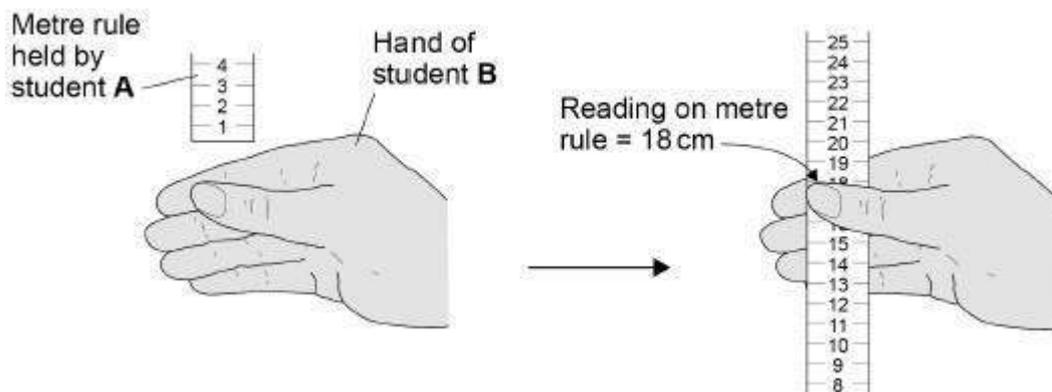
This is the method used.

1. Student **A** holds a metre rule just above student **B**'s hand, as shown in **Figure 1**.
2. Student **A** lets go of the metre rule.



3. Student **B** catches the metre rule as quickly as possible.
4. Student **A** writes down the reading from the scale on the metre rule.
5. Students **A** and **B** repeat steps 1-4 another four times.
6. Student **B** then drinks a cup of coffee.
7. After 15 minutes, students **A** and **B** repeat steps 1-5.

Figure 1

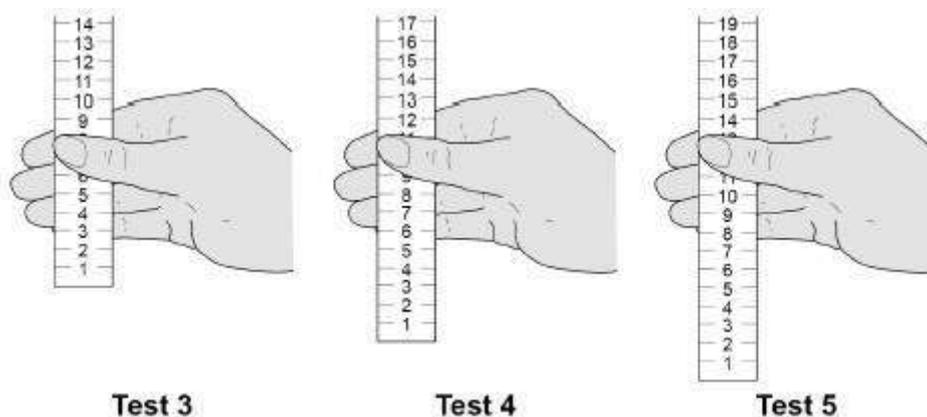


The table below shows some of the results.

| Test | Reading from scale on metre rule in cm | |
|------|--|-----------------------|
| | Before drinking coffee | After drinking coffee |
| 1 | 18 | 10 |
| 2 | 21 | 14 |
| 3 | 15 | |
| 4 | 12 | |
| 5 | 19 | |

Figure 2 shows the results **after** drinking the coffee for tests 3, 4 and 5

Figure 2



(d) Complete the table.



Use results from **Figure 2**.

(2)

The students made the following conclusion:

'Drinking coffee speeds up reactions.'

(e) Give evidence from the table above to support the students' conclusion.

(1)

(f) The students' conclusion may **not** be valid.

Suggest **two** improvements the students could make to their method.

1 _____

2 _____

(2)

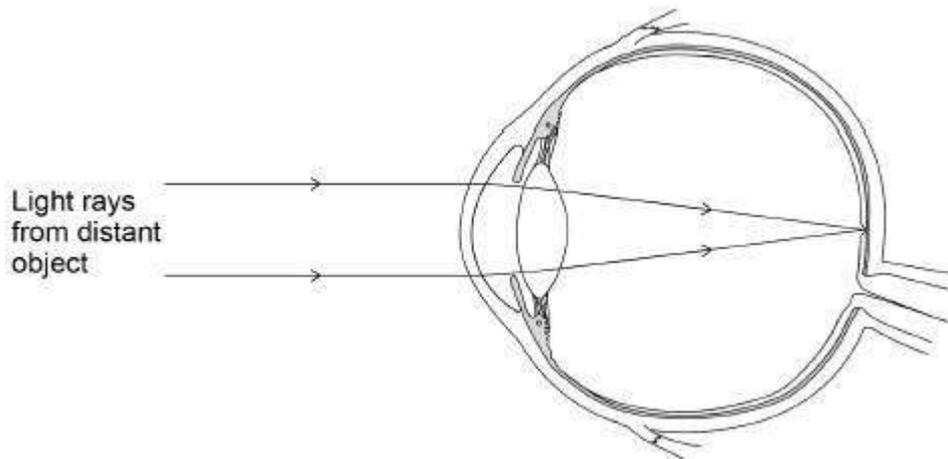
(Total 10 marks)

Q6.

The human eye can focus on objects at different distances.

Figure 1 shows how a clear image of a **distant** object is formed in a person's eye.

Figure 1



(a) Explain how the person's eye could adjust to form a clear image of a **nearer** object.



(3)
(Total 11 marks)

Q7.

Many human actions are reflexes.

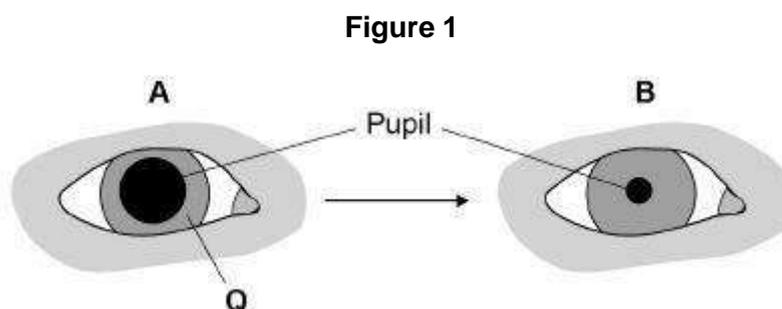
(a) Which **two** of the following are examples of reflex actions?

Tick **two** boxes.

- Jumping in the air to catch a ball
- Raising a hand to protect the eyes in bright light
- Releasing saliva when food enters the mouth
- Running away from danger
- Withdrawing the hand from a sharp object

(2)

Figure 1 shows how the size of the pupil of the human eye can change by reflex action.



(b) Name **one** stimulus that would cause the pupil to change in size from **A** to **B**, as shown in **Figure 1**.

(1)

(c) Structure **Q** causes the change in size of the pupil.



Name structure **Q**.

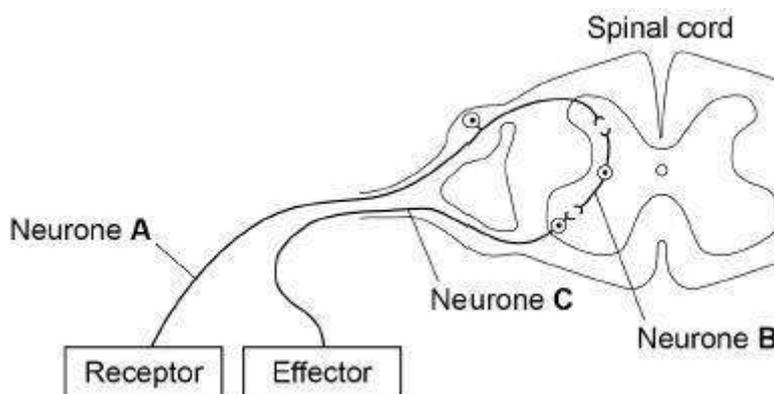
(1)

(d) Describe how structure **Q** causes the change in the size of the pupil from **A** to **B**.

(1)

(e) **Figure 2** shows some structures involved in the coordination of a reflex action.

Figure 2



Describe how the structures shown in **Figure 2** help to coordinate a reflex action.



(6)
(Total 11 marks)

Q8.

Three students measured their reaction times.

The students used a computer program.

The image below shows the image displayed on the computer screen.



This is the method used:

1. Sit facing the computer screen.
2. Click the mouse button as quickly as possible when the computer screen turns green.
3. Record the time taken as shown on the computer screen.
4. Repeat steps 2 and 3 a further 9 times.

The table shows the students' results.

| Attempt number | Time in milliseconds | | |
|----------------|----------------------|-----------|-----------|
| | Student A | Student B | Student C |
| 1 | 275 | 260 | 272 |
| 2 | 259 | 268 | 268 |
| 3 | 251 | 251 | 275 |
| 4 | 261 | 256 | 266 |
| 5 | 260 | 244 | 270 |
| 6 | 263 | 280 | 283 |



| | | | |
|-------------|-----|-----|-----|
| 7 | 259 | 468 | 274 |
| 8 | 256 | 258 | 278 |
| 9 | 255 | 255 | 286 |
| 10 | 248 | 277 | 275 |
| Mean | 259 | 282 | 275 |

(1 second = 1000 milliseconds)

- (a) Suggest why measuring reaction time with a computer is more accurate than measuring reaction time with a stopwatch.

(1)

- (b) The students measured 10 reaction times for each person rather than 3 reaction times.

Explain why.

(2)

- (c) Explain why the mean for student **B** has been calculated incorrectly.

Use information from the table.

(2)

- (d) Calculate the ratio of student **C**'s mean reaction time to student **A**'s mean reaction time.

Give your answer to 3 significant figures.



Ratio student **C** : student **A** = _____ 1

(2)

(e) Student **A** wanted to present his mean result in seconds, in standard form.

What is the correct way of doing this?

Tick **one** box.

259×10^{-3} seconds

0.259×10^{-3} seconds

2.59×10^{-1} seconds

0.259×10^{-4} seconds

(1)

(f) Student **C** said the results from this investigation showed that he had the fastest reactions.

Give **two** reasons why student **C**'s statement is **not** correct.

1.

2.

(2)

(g) The reaction the students investigated is **not** a reflex action.

Give the reason why.

(1)

(Total 11 marks)



Q9.

Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with his elbow resting on the edge of a table.
2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler and records the distance.
5. Steps 1 to 4 are then repeated.

The same method was also used with Student **A** dropping the ruler and Student **B** catching the ruler.

- (a) Give **two** variables the students controlled in their investigation.

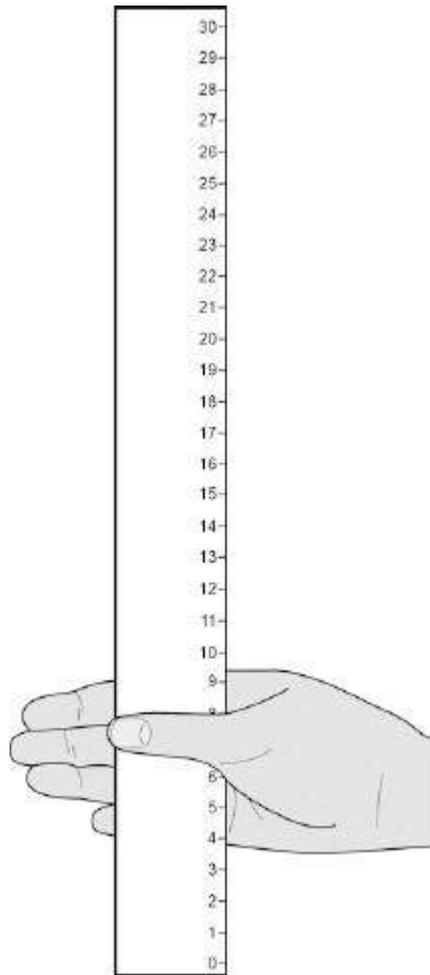
1.

2.

(2)

- (b) **Figure 1** shows one of the results for the Student **A**.

Figure 1



What is the reading shown in **Figure 1**?

Reading on ruler = _____ cm

(1)

(c) **Table 1** shows the students' results.

Table 1

| Test number | Distance ruler dropped in cm | |
|-------------|------------------------------|-----------|
| | Student A | Student B |
| 1 | 9 | 12 |
| 2 | 2 | 13 |
| 3 | 6 | 13 |
| 4 | 7 | 9 |
| 5 | 7 | 8 |



| | | |
|------|---|---|
| Mean | 7 | X |
|------|---|---|

Circle the anomalous result in **Table 1** for Student **A**.

(1)

(d) What is the **median** result for Student **B**?

Tick **one** box.

8

11

12

13

(1)

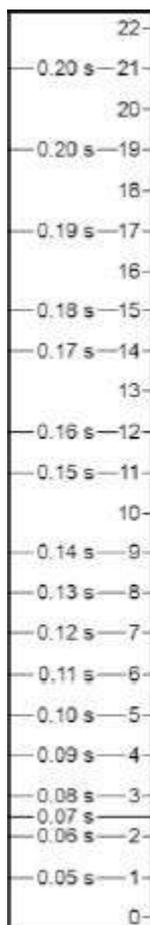
(e) Calculate the value of **X** in **Table 1**.

Mean distance ruler dropped = _____ cm

(1)

(f) **Figure 2** shows the scale used to convert distance of the ruler drop to reaction time.

Figure 2



Calculate how much faster the reaction time of Student **A** was compared to Student **B**.

Use **Figure 2** and **Table 1**.

Answer = _____ s

(2)

- (g) What improvement could the students make to the method so the results are more valid?

Tick **one** box.

Use alternate hands when catching the ruler

Carry out more repeats

Use a longer ruler for catching



Use more than two students to collect results

(1)

- (h) Student **A** carried out a second investigation to see the effect of caffeine on the reflex action.

Table 2 shows his results.

Table 2

| Test number | Distance ruler dropped in cm | |
|-------------|------------------------------|---------------|
| | Without caffeine | With caffeine |
| 1 | 9 | 5 |
| 2 | 6 | 5 |
| 3 | 9 | 4 |
| 4 | 6 | 7 |
| 5 | 10 | 4 |
| Mean | 8 | 5 |

Give **one** conclusion about the effect of caffeine on reflex actions.

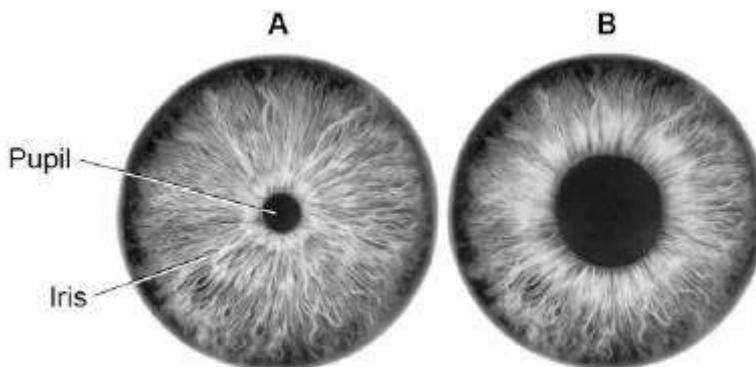
(1)

(Total 10 marks)

Q10.

Figure 1 shows a reflex in the iris of the human eye in response to changes in light levels.

Figure 1



@ Gandee Vasan/Stone/Getty Images

- (a) Describe the changes in the pupil and iris going from **A** to **B** in **Figure 1**.

Explain how these changes occur.

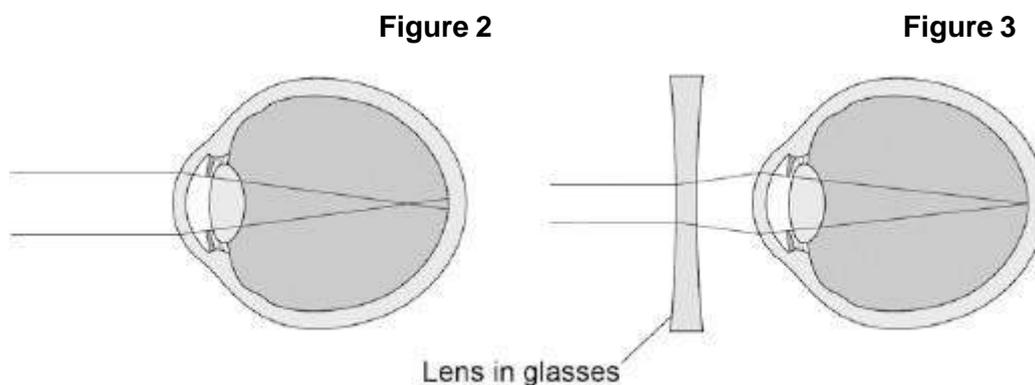
Refer to the changes in light level in your answer.

(4)

- (b) Some people wear glasses to improve their vision.

Figure 2 shows light entering the eye in a person with blurred vision.

Figure 3 shows how this condition is corrected with glasses.



Compare **Figure 2** and **Figure 3**.



Explain how the blurred vision is corrected.

(2)

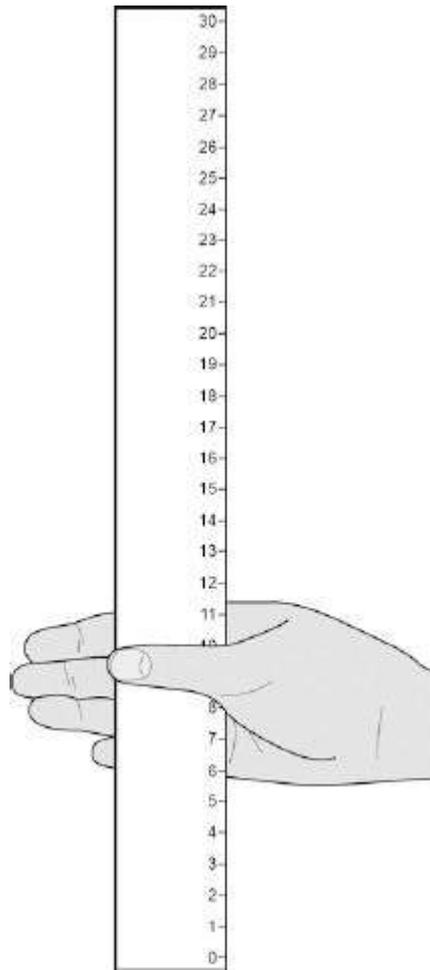
(Total 6 marks)

Q11.

Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with her elbow resting on the edge of a table.
2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler and records the distance, as shown in the diagram below.
5. Steps **1** to **4** were then repeated.



(a) Suggest **two** ways the students could improve the method to make sure the test would give valid results.

1.

2.

(2)

(b) The table below shows Student **A**'s results.

| Test Number | Distance ruler dropped in mm |
|-------------|------------------------------|
| 1 | 117 |
| 2 | 120 |
| 3 | 115 |



| | |
|---|-----|
| 4 | 106 |
| 5 | 123 |
| 6 | 125 |
| 7 | 106 |

What is the **median** result?

Tick **one** box.

106

115

116

117

123

(1)

- (c) The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{mean drop distance in cm}}{490}}$$

Give your answer to 3 significant figures

Mean reaction time = _____ s

(3)

- (d) The students then measured Student **A**'s reaction time using a computer program.

This is the method used.



1. The computer shows a red box at the start.
2. As soon as the box turns green the student has to press a key on the keyboard as fast as possible.
3. The test is repeated five times and a mean reaction time is displayed.

Student **A**'s mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give **two** reasons why.

1.

2.

(2)

- (e) A woman has a head injury.

Her symptoms include:

- finding it difficult to name familiar objects
- not being able to remember recent events.

Suggest which part of her brain has been damaged.

(1)

- (f) A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged.

(1)

(Total 10 marks)

Q12.

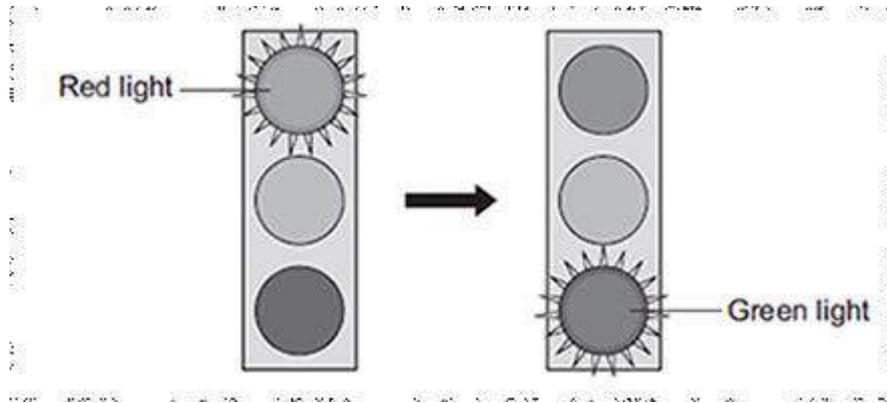
Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.



The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

- (a) Special cells detect the change in colour.
- (i) What word is used to describe special cells that detect a change in the environment?

Draw a ring around the correct answer.

receptor cells **reflex cells** **stimulus cells**

(1)

- (ii) Where in the body are the special cells that detect the change in colour of the traffic lights?

(1)

- (b) The student used the computer program on one computer to measure the reaction times of people of different ages.

- (i) Give **one** variable the student should control so that a fair comparison can be made between the people of different ages.

(1)

- (ii) The student did each measurement three times to calculate a mean value.



The table shows the results.

| Age in years | Mean reaction time in milliseconds |
|--------------|------------------------------------|
| 15 | 242 |
| 30 | |
| 45 | 221 |
| 60 | 258 |
| 75 | 364 |
| 90 | 526 |

The reaction times for the 30-year-old person were **192**, **174** and **180** milliseconds.

Calculate the mean reaction time of the 30-year-old person.

Mean reaction time = _____ milliseconds

(1)

- (iii) Which **one** of the following is an advantage of repeating each test three times and **not** doing the test just once?

Tick (✓) **one** box.

Any anomalies can be identified.

The results will be more precise.

There will be no errors.

(1)

- (iv) Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.



(2)
(Total 7 marks)

Q13.

This question is about the nervous system.

- (a) Describe the difference between the function of a receptor and the function of an effector.

In your answer you should give **one** example of a receptor and **one** example of an effector.

(4)

- (b) Synapses are important in the nervous system.

- (i) What is a synapse?

(2)

- (ii) Describe how information passes across a synapse.

(2)



(c) Reflexes may be co-ordinated by the brain or by the spinal cord.

(i) The reflexes from sense organs in the head are co-ordinated by the brain.

Name a sense organ involved in a reflex co-ordinated by the spinal cord.

(1)

(ii) The table shows information about reflexes co-ordinated by the brain and reflexes co-ordinated by the spinal cord.

| Organ co-ordinating the reflex | Mean length of neurones involved in cm | Mean time taken for reflex in milliseconds | Mean speed of impulse in cm per millisecond |
|--------------------------------|--|--|---|
| Brain | 12 | 4 | 3 |
| Spinal cord | 80 | 50 | |

Calculate the mean speed of the impulse for the reflex co-ordinated by the spinal cord.

Mean speed = _____ cm per millisecond

(1)

(iii) In reflexes co-ordinated by the brain there are **no** relay neurones.

Suggest why there is a difference in the mean speed of the impulse for the two reflexes.

(2)

(Total 12 marks)