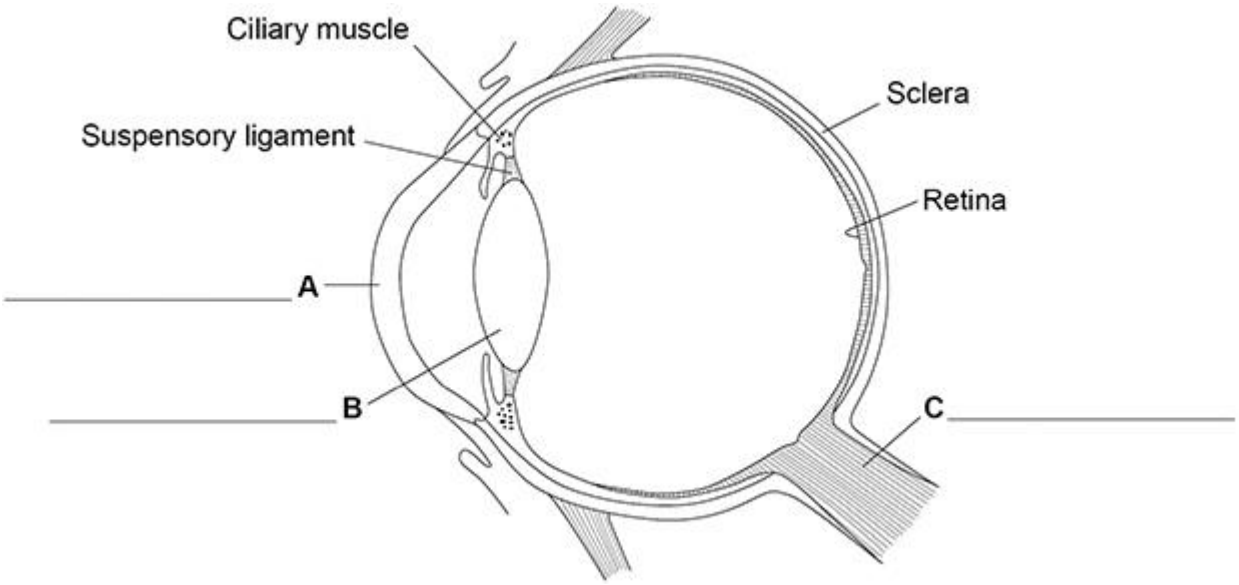
Questions are for both separate science and combined science students unless indicated in the question

Q1. (separate only)

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.

Figure 1



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

Choose answers from the box. **(separate only)**

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. **(separate only)**

By becoming longer ☐

By becoming thicker ☐

By becoming transparent ☐

(1)

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

Tick (✓) **two** boxes. **(separate only)**

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. **(separate only)**

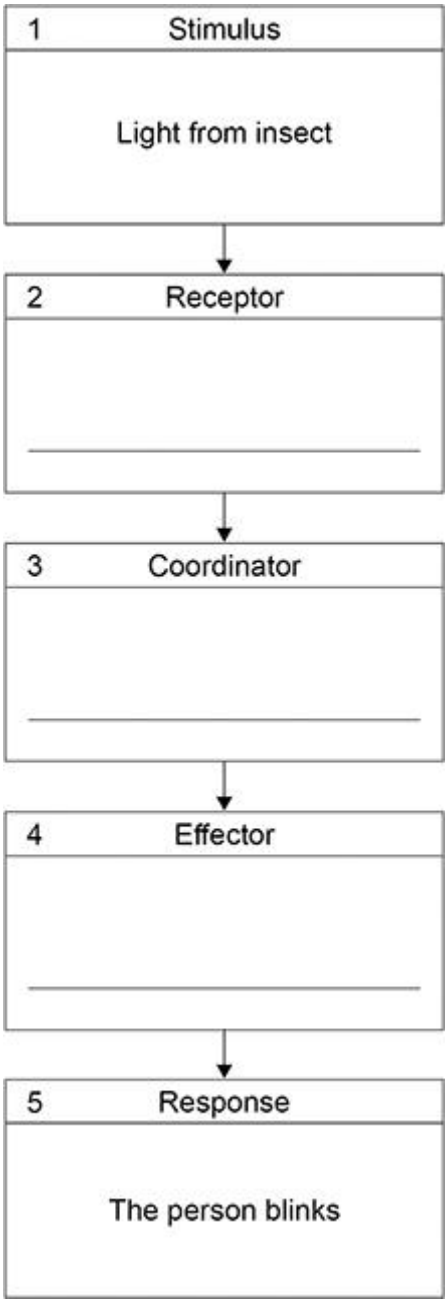
_____

(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**. **(separate only)**

brain	**cornea**	**iris**	**muscles**	**retina**

(2)

(Total 9 marks)

Q2.

Reflex actions are coordinated by the nervous system.

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

_____

_____

_____

_____

(2)

(b) A woman's hand accidentally touches a hot object.

The woman moves her hand away rapidly.

Describe how the woman's nervous system coordinates the reflex action.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(c) The endocrine system coordinates many internal functions of the body.

Give **three** ways coordination by the endocrine system is different from coordination by the nervous system.

1 _____

_____

2 _____

_____

3 _____

(3)

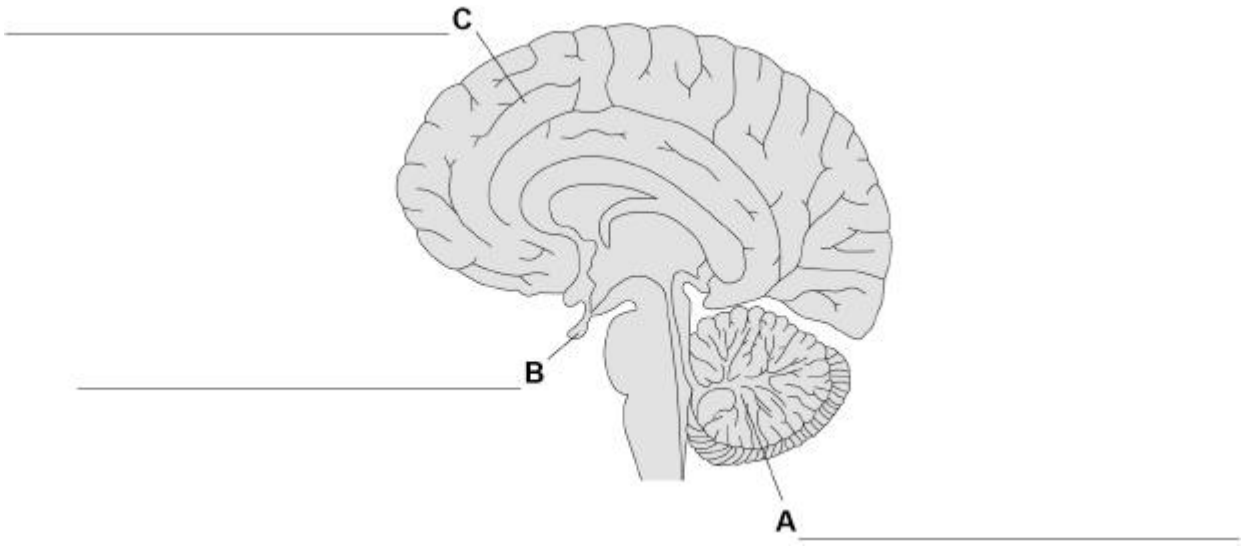
(d) Describe how hormones control the menstrual cycle.

(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. **(separate only)**

cerebellum	**cerebral cortex**	**medulla**	**pituitary gland**

(3)

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

Tick (✓) **one** box. **(separate only)**

Cerebellum ☐

Medulla ☐

Pituitary gland ☐

(1)

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

Which word describes the brain?

Tick (✓) **one** box.

Coordinator ☐

Effector ☐

Receptor ☐

Stimulus ☐

(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. **(separate only)**

Iris ☐

Lens ☐

Retina ☐

(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. **(separate only)**

Accommodation ☐

Magnification ☐

Reflection ☐

(1)

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

Tick (✓) **one** box. **(separate only)**

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. **(separate only)**

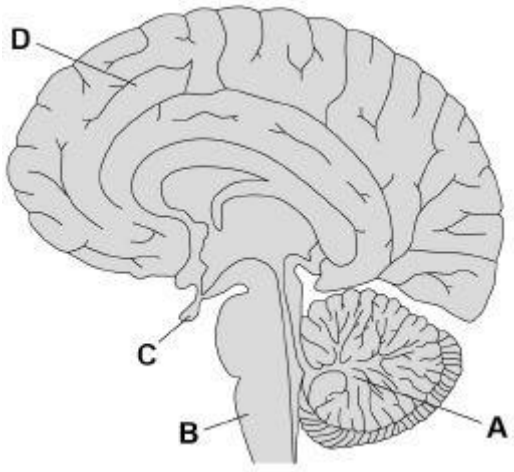
_____

(1)

(Total 12 marks)

Q4. (separate only)

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. **(separate only)**

A ☐ B ☐ C ☐ D ☐

(1)

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

_____

(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. **(separate only)**

_____

_____

_____

_____

_____

_____

(3)

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

You should include the names of structures in your answer. **(separate only)**

(3)

(e) The eyes of some birds contain cells that detect ultraviolet (UV) light.

UV light is reflected by some fruits and the urine of small mammals.

Explain how birds that detect UV light have evolved from birds that could not detect UV light. **(separate only)**

(6)

(Total 14 marks)

Q5.

The nervous system allows a person to detect stimuli.

(a) Draw **one** line from each stimulus to the sense organ that detects the stimulus.

Stimulus	Sense organ
Chemicals	Ear
Light	Eye
	Tongue

(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.

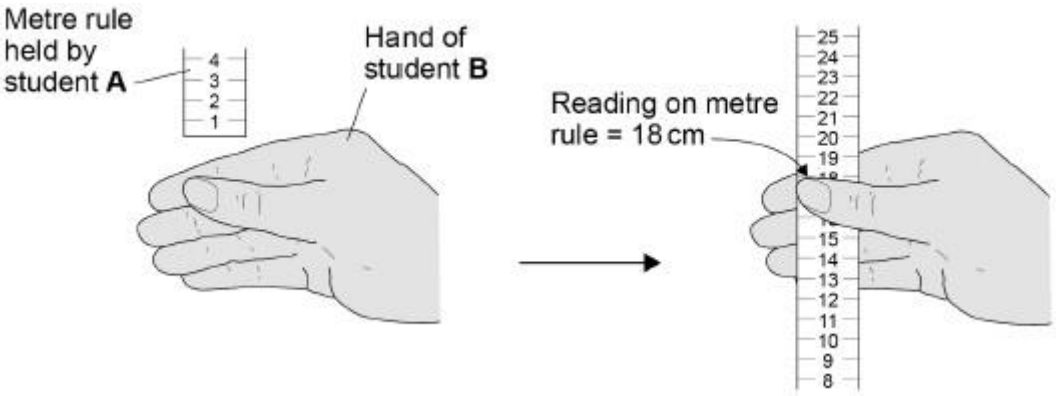
4. Student **A** writes down the reading from the scale on the metre rule.

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

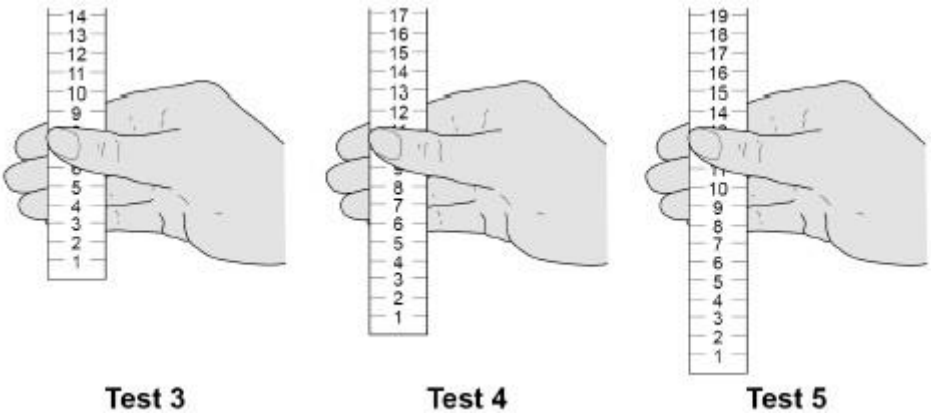


The table below shows some of the results.

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)

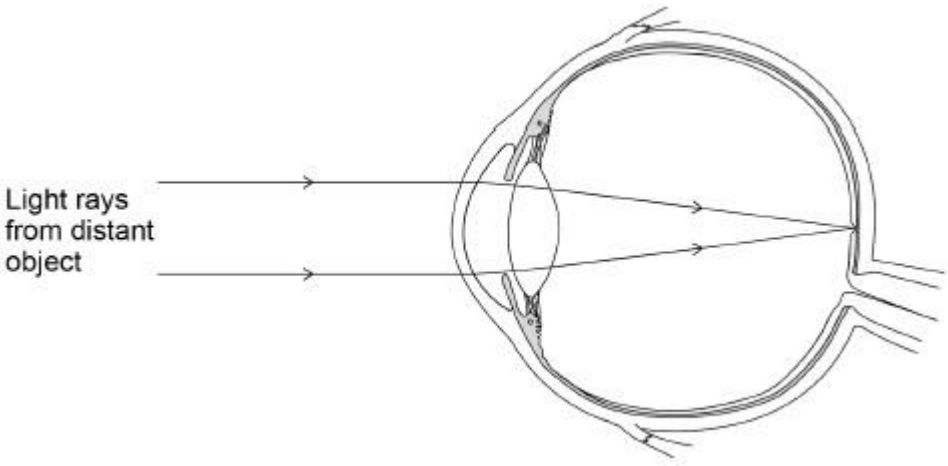
(Total 10 marks)

Q6. (separate only)

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. **(separate only)**

(6)

(b) Explain why a long-sighted person has difficulty seeing near objects clearly. **(separate only)**

(2)

(c) Long-sightedness can be corrected by wearing spectacles.

Describe how spectacle lenses can correct long-sightedness. **(separate only)**

_____

_____

_____

(3)

(Total 11 marks)

Q7.

Many human actions are reflexes.

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

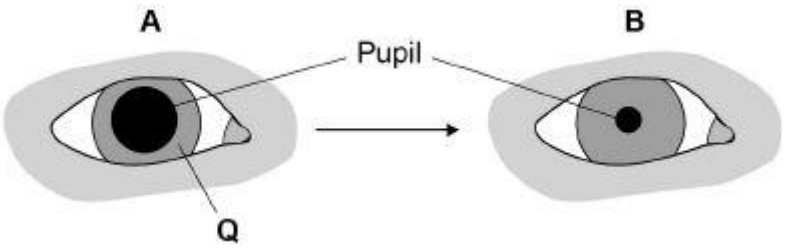
Tick **two** boxes.

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.

Figure 1



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

_____

(1)

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

Name structure **Q**. **(separate only)**

_____

(1)

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

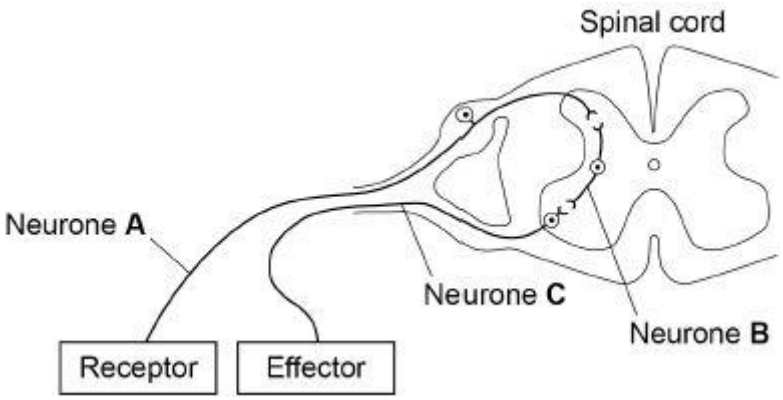
_____

_____

(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.

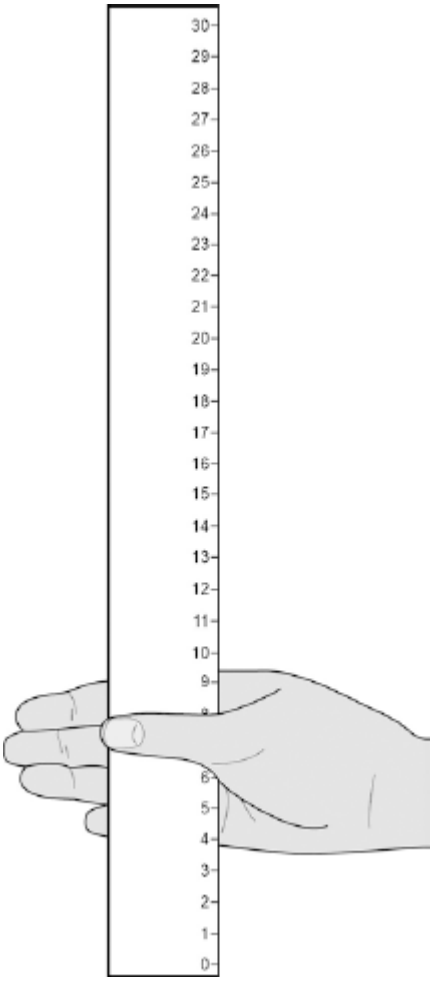
1. _____

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**.

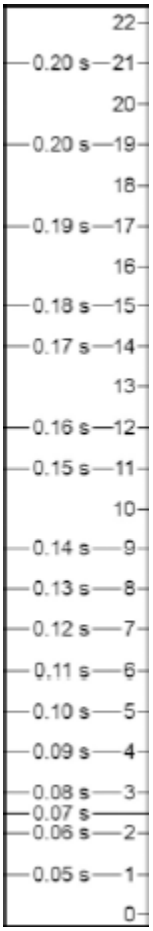
_____

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.

_____

_____

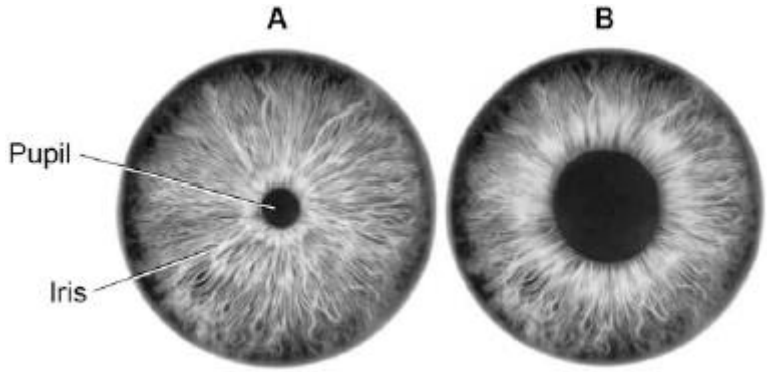
(1)

(Total 10 marks)

Q10. (separate only)

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

Figure 1



(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. **(separate only)**

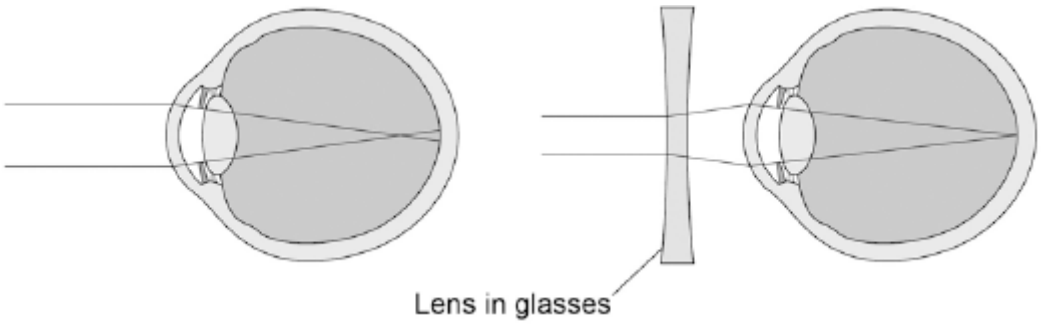
(4)

(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.

Figure 2 **Figure 3**



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

Explain how the blurred vision is corrected. **(separate only)**

_____

_____

_____

_____

_____

_____

(2)

(Total 6 marks)

Q11.

Two students investigated reflex action times.

This is the method used.

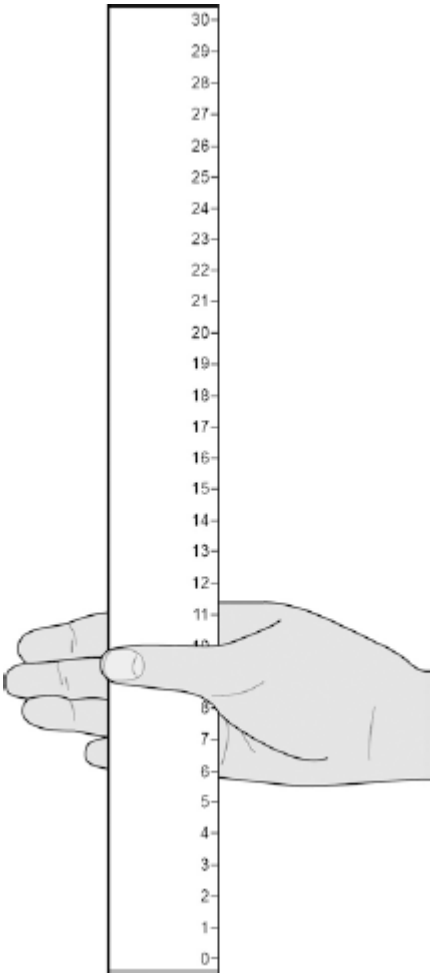
1. Student **A** sits with her elbow resting on the edge of a table.

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:

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. **(separate only)**

_____

(1)

(f) A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged. **(separate only)**

_____

(1)

(Total 10 marks)

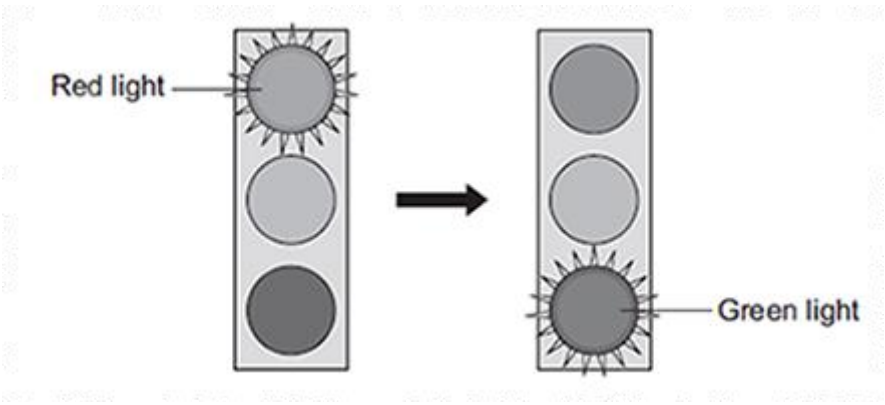
Q12.

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)