1 Contraceptives are used to prevent pregnancy.

(a) Draw **one** line from each contraceptive to the method of preventing pregnancy.

Contraceptive device

Method of preventing pregnancy

Contains hormones to stop eggs maturing

Prevents the sperm reaching the egg

Kills sperm

Slows down sperm production

Stops an embryo implanting in the uterus

(3)

The pie chart shows the percentages of people who used different types of contraception in the UK in 2016.

The people are aged 16–49 years.

(b)   Determine the percentage of people who used no contraception.

_____

_____

_____

Percentage of people =_____%

(2)

(c)   Suggest **two** reasons why a person aged 16–49 years might **not** be using contraception.

1. _____

_____

2. _____

_____

(2)

The table shows some information about three methods of contraception.

Method	Effectiveness	Other information
Combined pill	99.5%	• Must be taken every day • Free from your GP or sexual health clinic • May cause headaches
Male condom	98.0%	• May split or leak • Only used when you have sexual intercourse • Inexpensive in supermarkets or free from a sexual health clinic
Sterilisation	100.0%	• Needs an operation in hospital • Usually cannot be reversed

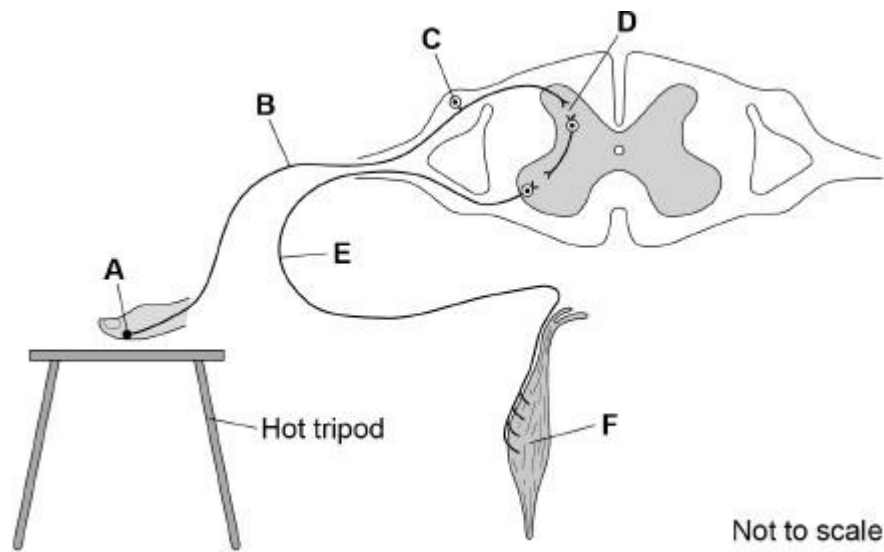(d)   A man and a woman plan to start a family in 5 years' time.

Compare the risks and benefits for this couple of the three methods of contraception.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)
(Total 11 marks)

2   The diagram shows a reflex arc that moves the arm if the hand touches something hot.

Hot tripod

Not to scale

(a)   Which part is the receptor?

Tick **one** box.

A ☐   B ☐   D ☐   F ☐

(1)

(b)   Which part is the effector of the reflex action?

Tick **one** box.

A ☐   B ☐   D ☐   F ☐

(1)

(c)   Which part shows a sensory neurone?

Tick **one** box.

B ☐   D ☐   E ☐   F ☐

(1)

(d)   Which part shows a synapse?

Tick **one** box.

A ☐   B ☐   D ☐   E ☐

(1)

(e)   Part **C** contains DNA.

Which part of the nerve cell is **C**?

Tick **one** box.

Cell membrane   ☐

Cytoplasm   ☐

Mitochondrion   ☐

Nucleus   ☐

(1)

(f)   Reflex actions are automatic and do not involve thinking.

Why is this an advantage?

_____

_____

(1)

(g) Which two factors can make you slower to react to a stimulus?

Tick **two** boxes.

Alcohol ☐

Caffeine ☐

Daylight ☐

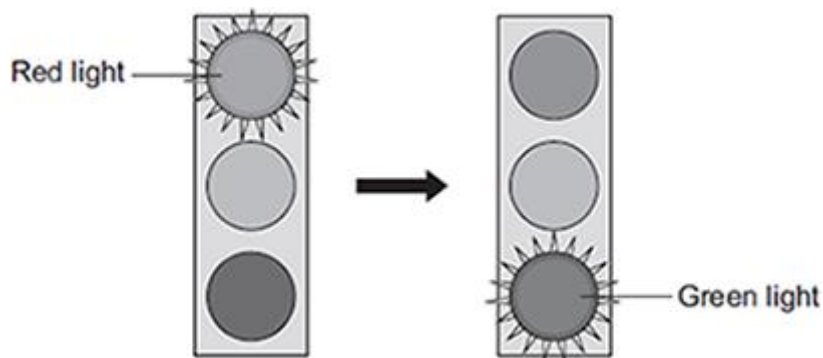Practice ☐

Tiredness ☐

(2)

(Total 8 marks)

3 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.

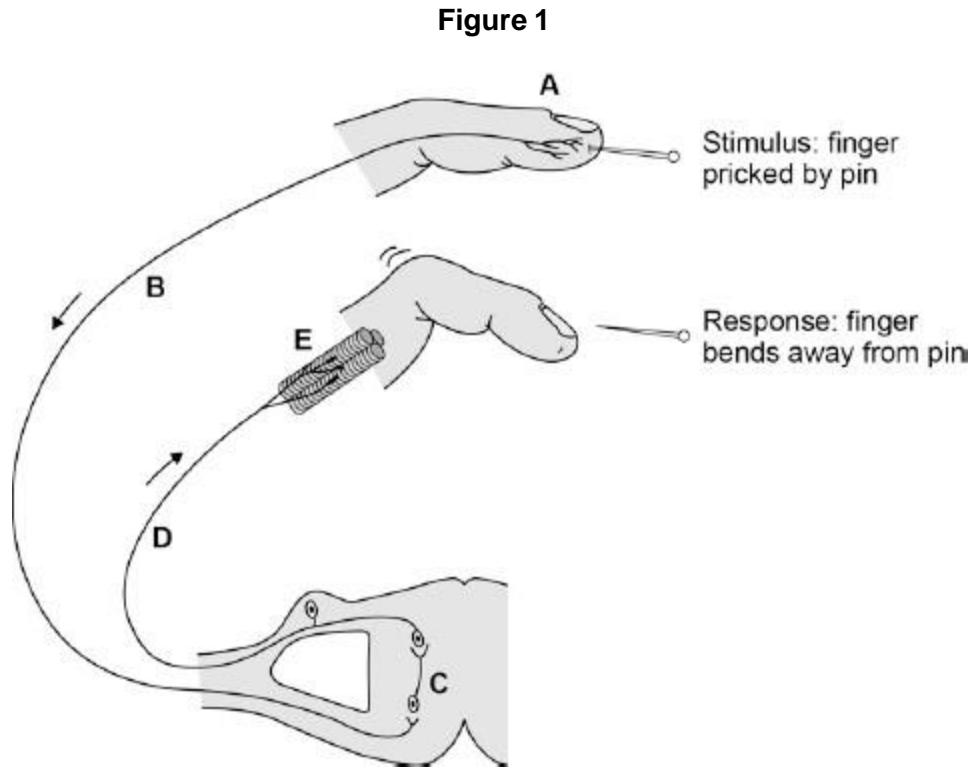Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.

_____

_____

_____

_____

(2)
(Total 7 marks)

4   Our nervous system controls our reactions.

Figure 1 shows the part of the nervous system involved in the rapid response to a stimulus.

Figure 1

(a)   What is this type of rapid response called?

Tick **one** box.

Circular action   ☐

Fast action   ☐

Forced action   ☐

Reflex action   ☐

(1)

(b)   Features of the nervous system are labelled **A**, **B**, **C**, **D** and **E** on **Figure 1**.

Draw **one** line from each feature to the correct label from **Figure 1**.

Feature		Label
		A
Effector		B
Relay neurone		C
Sensory neurone		D
		E

(3)

(c)   Two students compare their reactions using a ruler.

This is the method used.

1.   Student **A** sits with his elbow on a table top.

2.   Student **B** holds the ruler so the bottom of the ruler is level with the top of student **A**'s thumb.

3.   Student **B** drops the ruler.

4.   Student **A** catches the ruler.

5.   Record the drop distance.

6.   Repeat steps 1 to 5 four more times.

7.   Repeat the whole experiment with student **A** dropping the ruler and student **B** catching it.
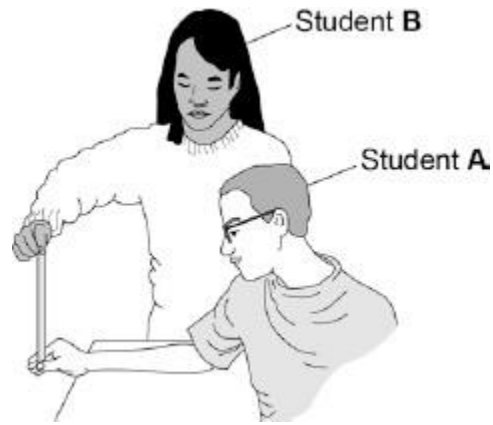
Both students are right-handed.

The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

Student **A** uses his right hand to catch the ruler.

Student **B** uses her left hand to catch the ruler.

Complete the sentence.

Use an answer from the box.

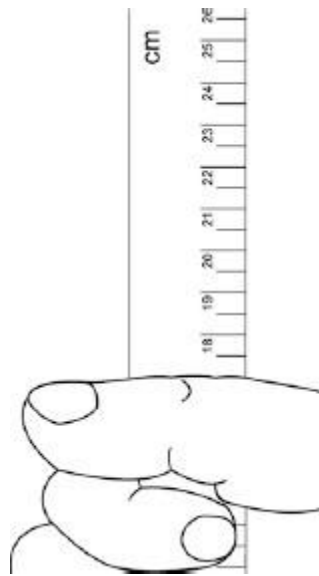| control	dependent	independent

The drop distance was the_____variable.

(1)

The table below shows the students' results.

Student	Drop distance in cm				
	Test 1	Test 2	Test 3	Test 4	Test 5
Student **A**	17.5	15.5	15.0	23.5	17.0
Student **B**	20.5		19.5	21.0	19.0

Figure 2 shows student **B**'s Test 2 result.

Figure 2

Use **Figure 2** to complete the missing result for Test 2.

Write the answer in the table above.

(1)

(e)   What was the resolution of the ruler the students used?

Tick **one** box.

0.1 cm ☐

0.5 cm ☐

1 cm ☐

10 cm ☐

(1)

(f)   One of the results in the table above is anomalous.

Identify the anomalous result.

Give the reason why you chose your answer.

_____

_____

_____

(2)

(g)   The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

The results in the table above are not a good test of the hypothesis.

What is one reason why?

Tick **one** box.

The drop distances are very variable	☐
The drop distance for Student **A** is sometimes bigger than the drop distance for Student **B**	☐
The results are for the left and right hands of different people	☐
The drop distances are not measured accurately enough	☐

(1)
(Total 10 marks)

5   Blood sugar levels in the body are controlled by insulin.

(a)   How does insulin travel around the body?

_____

_____

(1)

(b)   The table below shows the blood sugar levels for two people after eating a meal.

Time after eating in hours	Blood sugar levels in mg per 100 cm³ of blood	
	Person A	Person B
0	70	130
1	150	230
2	90	185
3	80	165
4	75	140

Use data from the table above to complete the graph in the figure below.

Plot the points for person **A**.

The first two points have been plotted for you.

Draw a line through all the points.
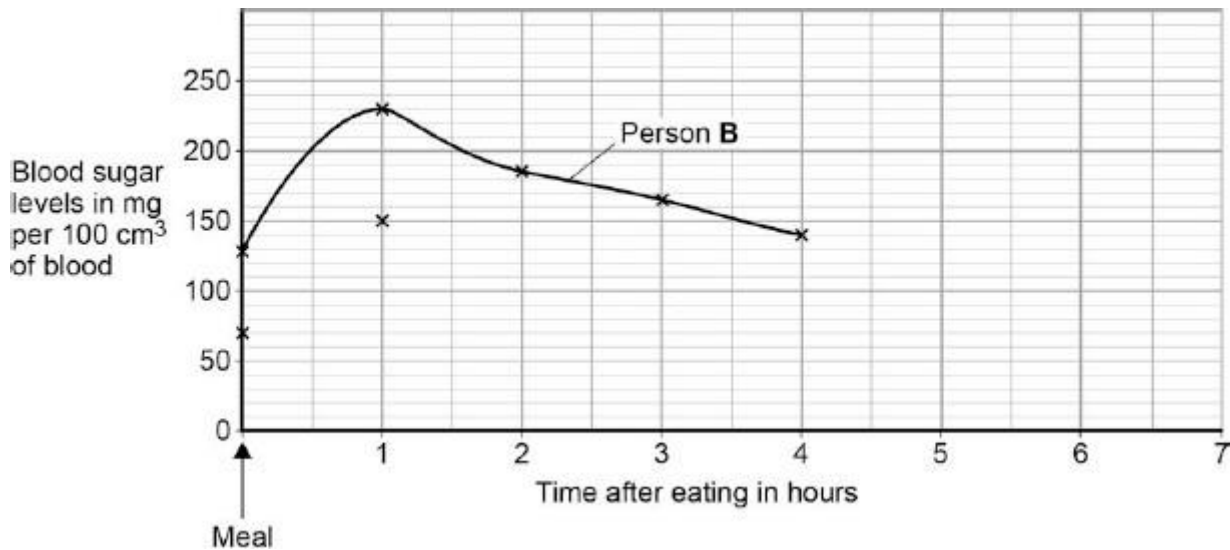
(3)

(c)   How long after the meal is person **B**'s insulin production at its peak?

_____

_____

(1)

(d) What is the greatest **decrease** in the blood sugar level of person **B** in an hour?

_____

_____

_____

Decrease = _____ mg per 100 cm^3

(2)

(e) Estimate how long after eating the meal it will take for person **B**'s blood sugar level to return to the level before the meal.

Show your working on the figure above.

_____

_____

(2)

(Total 9 marks)

6   A person with Type 1 diabetes does **not** produce enough of the hormone insulin.

(a) Where is the hormone insulin produced?

Tick **one** box.
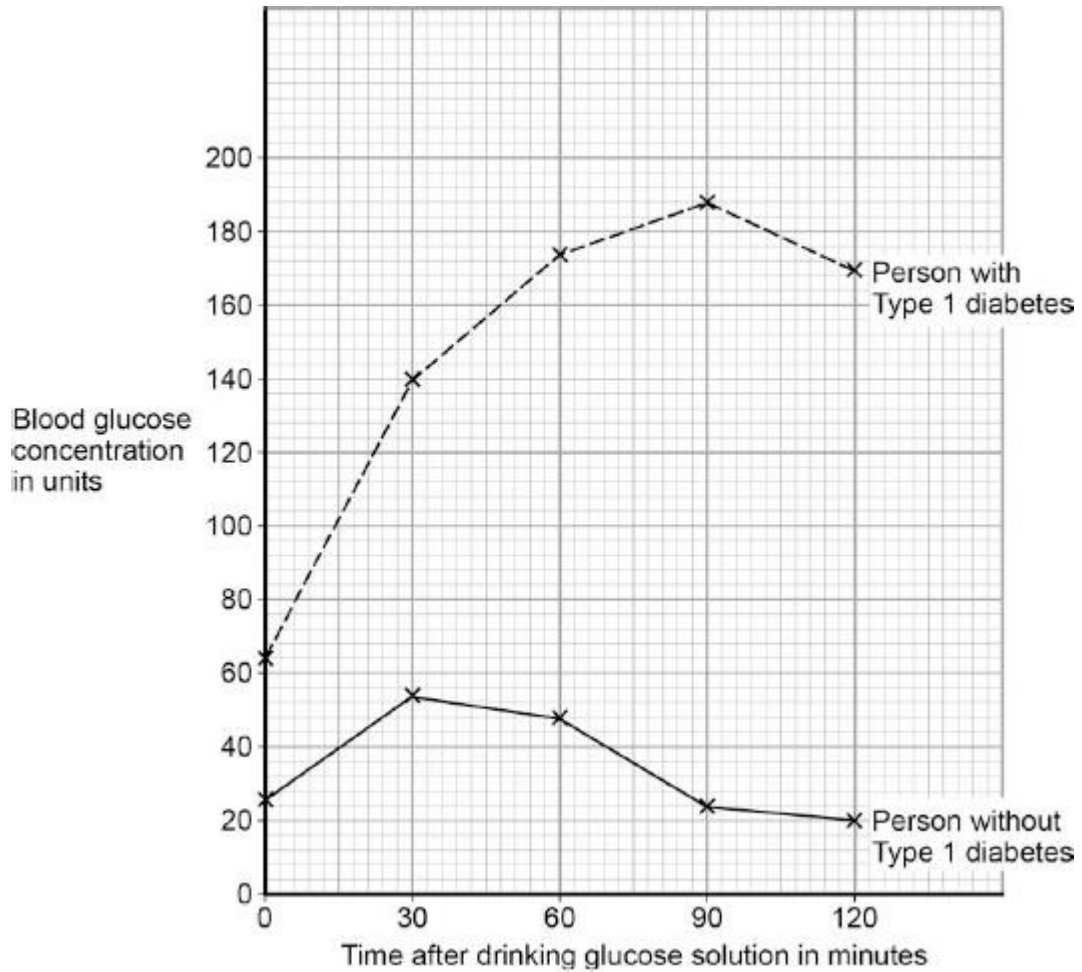
Brain ☐

Pancreas ☐

Pituitary ☐

Thyroid ☐

(1)

(b) How does insulin travel around the body?

_____

_____

(1)

(c) The same concentration and volume of glucose solution was given to two people.

- Person with Type 1 diabetes.

- Person without Type 1 diabetes.

The figure below shows how the blood glucose concentration of these two people changed after they each drank a glucose solution.

Look at the figure above.

Compare the blood glucose concentrations of the two people.

Include similarities and differences in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d)   People with diabetes may be asked to control their diet.

Explain how this can help to reduce the risk of developing health problems.

_____

_____

_____

_____

_____

_____

(3)
(Total 9 marks)

Mark schemes

1   (a)
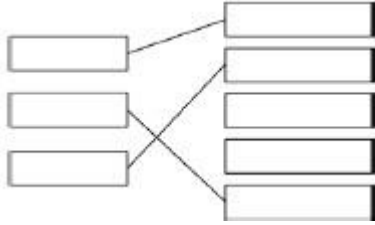
1
1
1

(b)   23%

*allow **1** mark for evidence of pill + condom = 180°/50%*

2

(c)   any **two** from:
- want to have a baby
- not having sex
- past the menopause
- pregnant

allow any sensible reason

2

(d)

Level 2: Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	3-4
Level 1: Relevant features are identified and differences noted.	1-2
No relevant content	0
Indicative content **combined pill** • **A** – easy to take, very effective and free on NHS, but • **D** – it can cause headaches/side effects, must remember to take it every day **condom** • **A** – only need it when you have sex, no side effects, very inexpensive, but • **D** – it is not as reliable, more difficult to use **sterilisation** • **A** – 100% effective but • **D** – probably will not be able to have a family, risks of surgery	

4

[11]

2   (a)   **A**

1

(b)   **F**

1

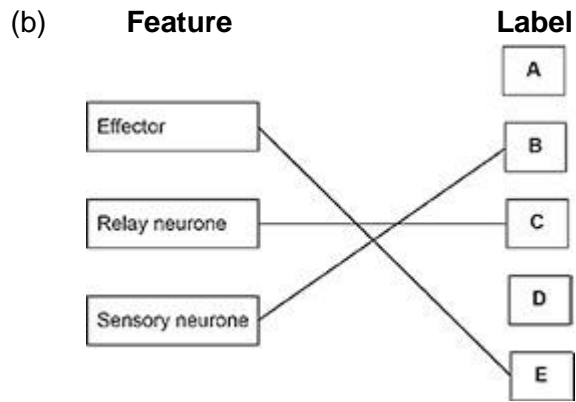(c)   **B**

1

(d)   **D**

1

(e)   nucleus

1

(f)   (makes reactions) faster

allow to reduce risk of damage / burns

allow for protection / safety

1

(g)   alcohol

1

tiredness

1

[8]

3   (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]

4   (a)   Reflex action

1

(b) **Feature**   **Label**

Effector → B

Relay neurone → C

Sensory neurone → E

extra lines from the left negate the mark

3

(c) dependent

1

(d) 17.0

allow answers in range 17.0–17.3 cm

1

(e) 0.5 cm

1

(f) 23.5

1

does not fit the pattern **or** at least 5 cm higher than the other values

1

(g) The results are for the left and right hands of different people

1

[10]

5 (a) in the blood(stream)

allow plasma

ignore dissolved or in solution

1

(b) all three plots correct

*accept two correct plots for **1** mark*

2

suitable line drawn

1

(c) 1 hour

1

(d) 230−185

identification of steepest part of graph and correct readings taken

1

= 45

1

(e) line on graph showing extrapolation for person **B**

correct value read from graph (at 130 mg per 100 cm^3)

*allow **1** mark for a value of 4.5–5 hours if no extrapolation shown*

2

[9]

6 (a) pancreas

1

(b) (in the) blood(stream)

allow in the (blood) plasma

1

*ignore dissolved **or** in solution*

(c) any **two** from:

- concentration rises and falls in both people
- concentration is higher at start / always in person with diabetes
- concentration rises higher in person with diabetes

  allow correct use of figures

2

plus any **two** from:

- concentration rises more rapidly in person with diabetes
- concentration stays high for longer in person with diabetes
- concentration does not return to starting level during test in person with diabetes, yet concentration returns to starting concentration by 90 minutes in person without diabetes
- concentration goes below starting concentration only in person without diabetes

2

(d) reduce carbohydrate / glucose / sugar in diet

1

(so) blood glucose concentration does not increase as much

1

(so) there is reduced named effect (of prolonged high blood glucose)

allow reduced short or long term consequences such as tiredness

or

increase urination

or

thirst

or *eye / kidney / nerve / heart disease*

1

[9]