Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3400U20-1

S18-3400U20-1

BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms

FOUNDATION TIER

TUESDAY, 15 MAY 2018 – AFTERNOON

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**11**	
2.	**14**	
3.	**8**	
4.	**7**	
5.	**12**	
6.	**8**	
7.	**7**	
8.	**13**	
Total	**80**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **6***(a)* is a quality of extended response (QER) question where your writing skills will be assessed.

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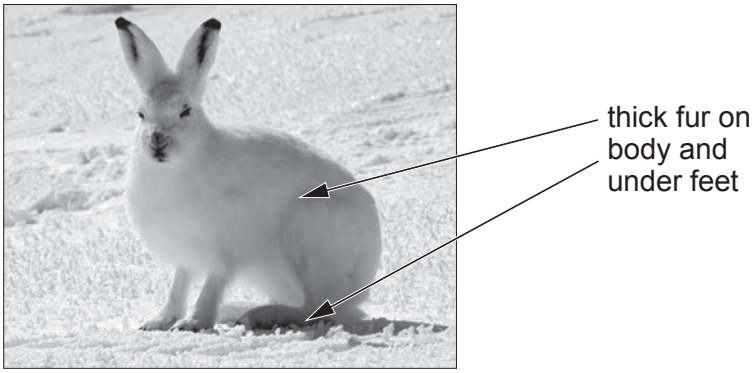
Answer **all** *questions*

1. The photograph shows an arctic hare *(Lepus arcticus)*.



(a) The table below shows some classes of vertebrate animals.

Class	Features of animals	Examples
fish	skin with scales	goldfish, cod
reptiles	skin with scales	crocodiles, snakes
birds	skin with feathers	eagle, pigeon
mammals	skin with hair	horse, cat

(i) Use the information above and your own knowledge to complete the classification of the arctic hare. [3]

Kingdom animal

Phylum vertebrate

Class .....

Genus .....

Species .....

(ii) Why do scientists use scientific names for living organisms? [1]

.....

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(b) Read the information about the arctic hare and use it to answer the questions which follow.

The arctic hare lives in northern countries where the climate is very cold. The average life expectancy is five years. Each has a body mass of 5 – 7 kg and 20% of this is a layer of fat under the skin, which helps to reduce heat loss. They live in large groups of about 200 individuals and huddle together while sleeping, to retain heat.

Arctic hares feed on berries, twigs and moss which they can dig out of snow with their strong feet. Only a few other species eat the same food as the hares but many others, such as foxes, wolves and lynx kill and eat large numbers of hares.

(i) Complete the table below by writing '**true**' or '**false**' for each of the statements about the arctic hare. [3]

Statement	True or False
All arctic hares live for at least five years.	
Arctic hares have little inter-specific competition for food.	
The population size of arctic hares is affected by predation.	
The layer of fat under the skin raises the body temperature.	

(ii) Explain why arctic hares are at a high risk of spreading disease while they sleep. [2]

.....

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(c) Give **two** reasons why the arctic hare's coat increases its chances of survival. [2]

.....

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2. The concentration of glucose in the blood is normally between 60 mg and 160 mg per 100 cm^3 of blood. Insulin reduces the concentration and prevents it from rising above the normal level.

(a) State the name of the organ which produces insulin. [1]

.....

(b) Doctors investigated the concentration of blood glucose in Kate and John.
They suspected that Kate had diabetes but they knew that John did not.

Their blood glucose was measured after taking a glucose drink.
The results for John are shown in the table below. Kate's results are shown on the graph.

Time (hours)	John's blood glucose level (mg / 100 cm^3)
0	80
0.5	115
1.0	134
1.5	110
2.0	95
2.5	84

(i) Complete the graph of results by: [4]

I. drawing an arrow on the axis for glucose concentration to show the **maximum normal concentration** of blood glucose (the minimum has been done for you);

II. plotting the blood glucose results for John;

III. joining your plots with a ruler and labelling your line.

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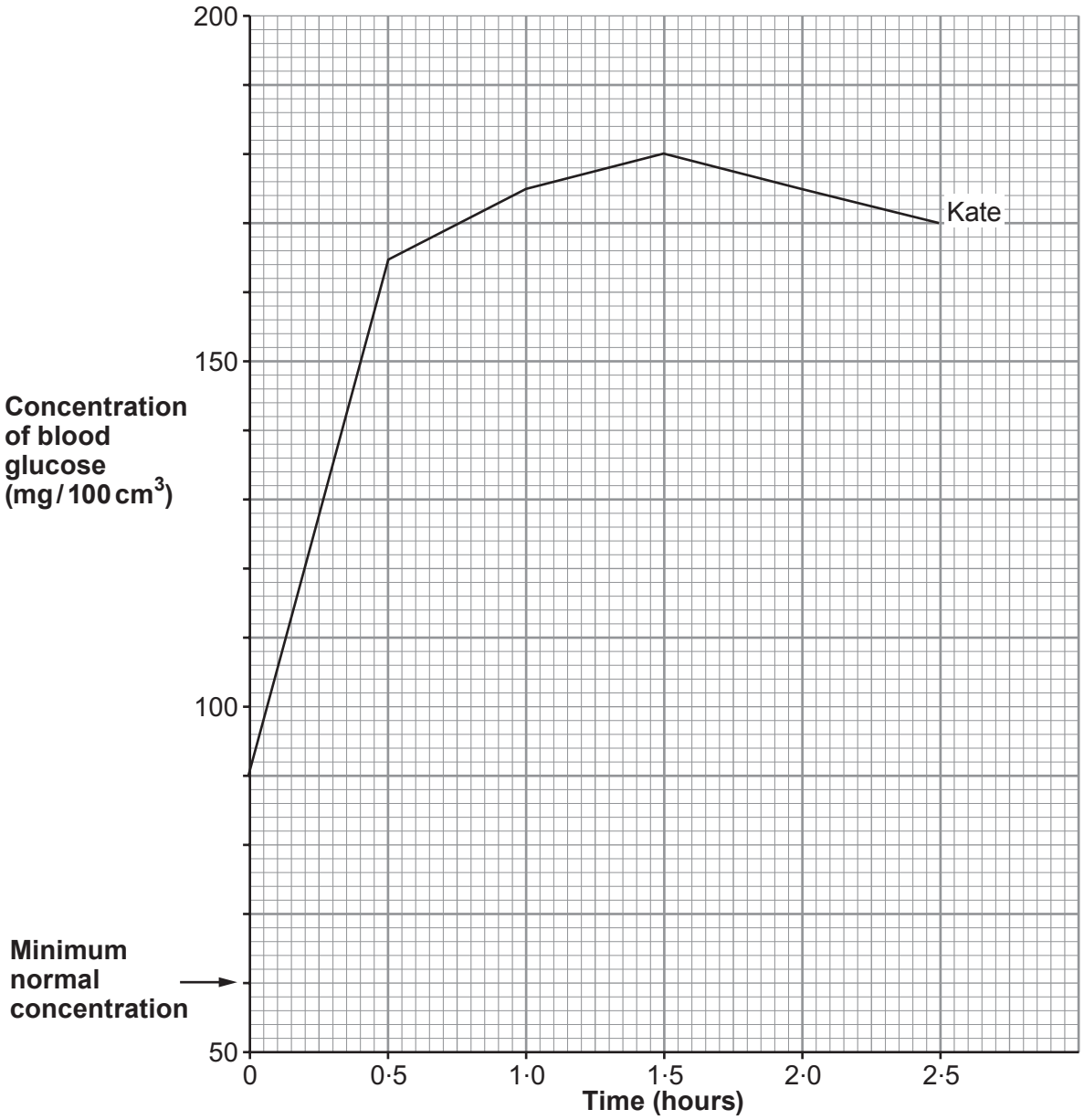
Graph of results



Use the graph to answer the questions.

(ii) At what time does insulin start to affect the concentration of glucose in John's blood? Give a reason for your answer. [2]

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(iii) How do the results for Kate at 0.5 hours show that she has diabetes? [1]

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(iv) Describe how the results for Kate are different from those of John, between 0.5 and 2 hours. [3]

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(v) The doctors concluded that Kate had diabetes. How could they increase the confidence they had in their results? [1]

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(c) (i) State **one** way in which Kate's diabetes could be treated. [1]

.....

(ii) Arthur is 70 years old. He produces insulin but his liver cells do not respond to it. State the precise name of this medical condition. [1]

.....

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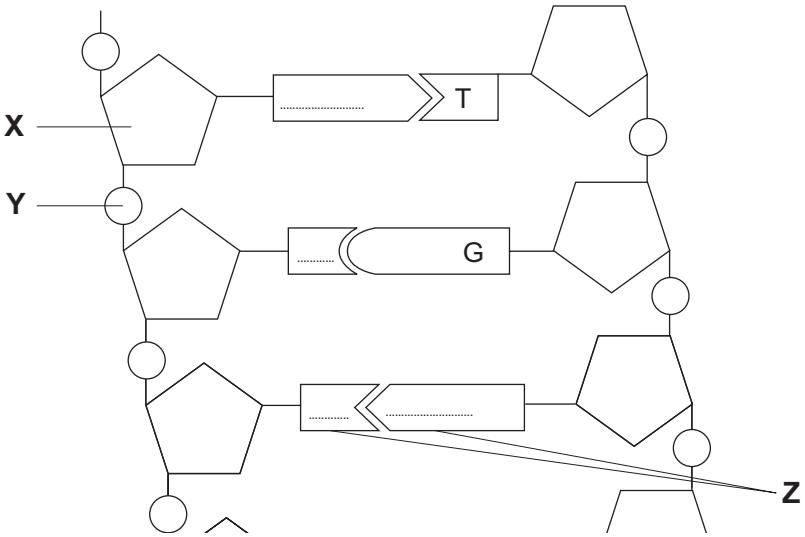
3. *(a)* The diagram below shows a small section of DNA.



(i) Which one of the following pairs of substances correctly describes labels **X** and **Y** on the diagram?

Underline your answer [1]

salt and sugar

sugar and phosphate

acid and phosphate

salt and acid

(ii) The structures labelled **Z** are bases.

Complete the letter names for the **four** missing bases on the diagram. [2]

(iii) State why the order of the bases in DNA is important in the production of proteins. [2]

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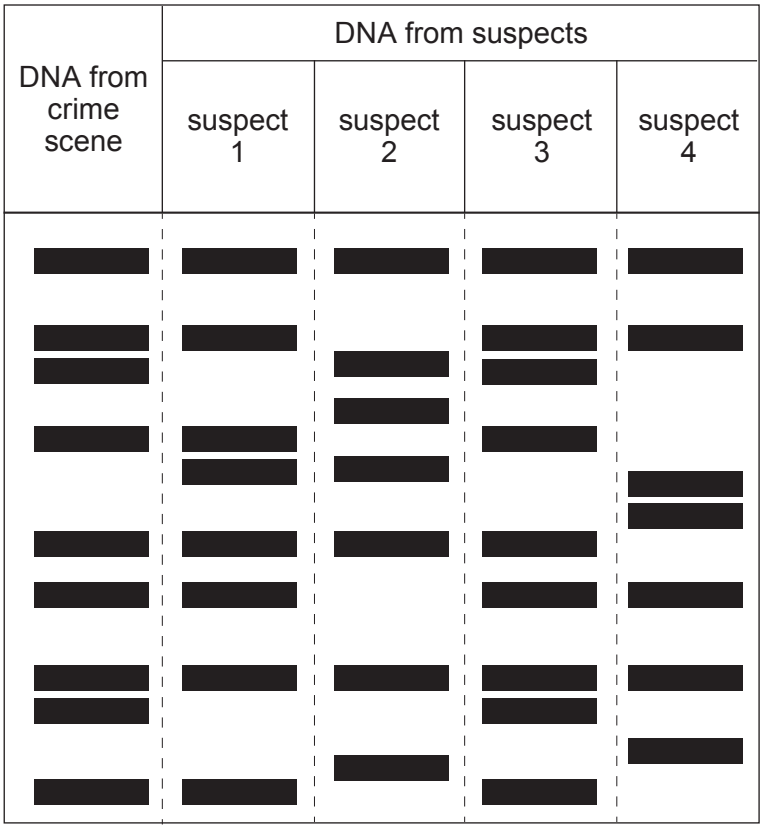
(b) Apart from identical twins, no two persons have identical DNA. Samples of DNA can be analysed to produce DNA profiles which can be used to identify individuals in criminal investigations.

The diagram below shows five DNA profiles.



(i) From the diagram, identify the suspect whose DNA was found at the crime scene. Give a reason for your answer. [1]

Suspect .....

Reason .....

(ii) Apart from criminal investigations, state **one** *other* use of DNA profiling. [1]

.....

(iii) After DNA profiles have been used in investigations they are often retained for future reference. Suggest **one** reason why some people may object to their DNA profiles being retained by the police. [1]

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4. In 1825, plant collectors brought Japanese knotweed *(Fallopia japonica)* into the UK. It spread into many habitats, mostly near rivers. It is now out of control in most areas, eliminating other plant species and damaging roads and buildings.

Japanese knotweed in summer

sap-sucking louse

Japanese knotweed grows rapidly in summer. Plants reach 4 metres in height and underground stems grow to 25 metres in length.

Scientists working for the Welsh government investigated the use of a sap-sucking louse *(Aphalara itadori)*, to destroy Japanese knotweed in a number of trials in parts of the UK.

In the trials, the louse reduced the growth of Japanese knotweed by 60%. The louse did not harm any other species and reproduced quickly in summer. Most of the lice, however, died in the winter.

(a) (i) Which of the following describes Japanese knotweed in the UK? Write the correct letter in the box. [1]

A an endangered alien species

B an alien invasive species

C an endangered native species

D a native invasive species

answer ☐

(ii) How does Japanese knotweed affect biodiversity in the areas where it grows in the UK? Give a reason for your answer. [1]

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(b) (i) State the scientific term used when an organism is used to destroy a pest species. [1]

.....

(ii) Calculate the length of underground stems produced in Japanese knotweed when the sap-sucking louse is present. [2]

length = ... m

(c) (i) Following the trials, the scientists concluded that the sap-sucking louse was effective against Japanese knotweed as it reduced growth by 60%.

They also decided that it would be suitable to use this method on a wider scale throughout the UK. Give **one** piece of evidence which supports this decision. [1]

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(ii) How could these scientists check that the results were reproducible? [1]

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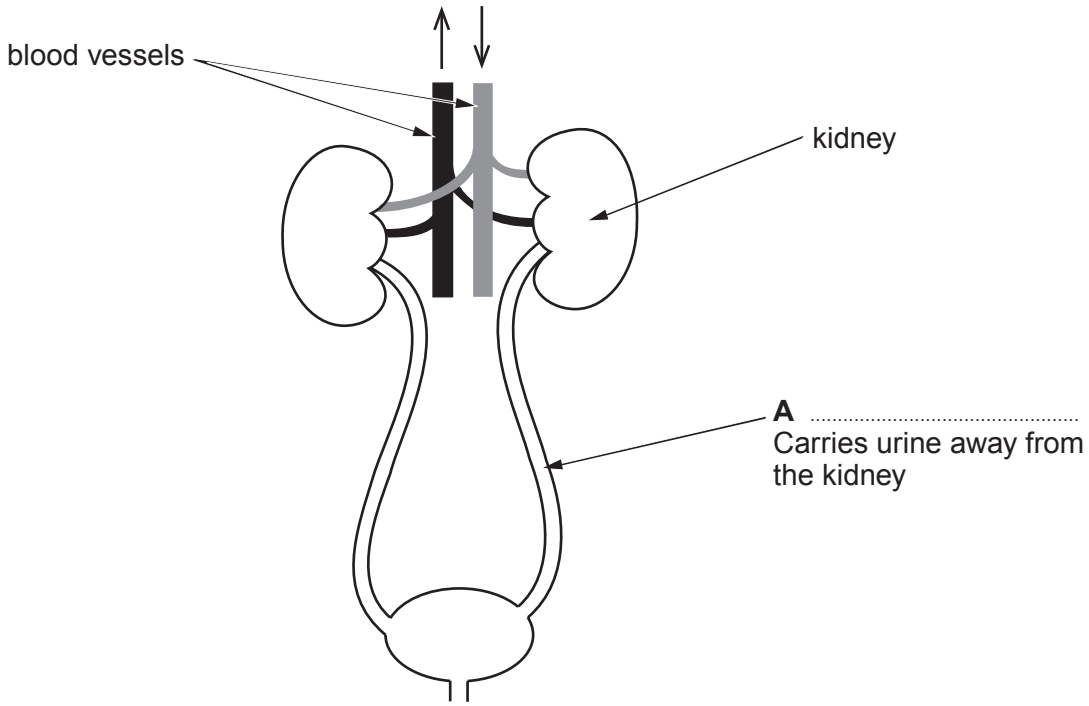
5. The diagram shows the human excretory system.



(a) **Complete** label **A** on the diagram. [1]

(b) A doctor investigated the concentrations of some substances present in the blood entering and leaving a patient's kidneys.

Substance	Concentration in blood (a.u.)	
	blood entering kidney	blood leaving kidney
glucose	168	168
salt (sodium)	35	33
protein	180	150
urea	314	11

(i) From the table, state the waste substance which would be present in the patient's urine at the highest concentration. [1]

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(ii) The doctor thought that this patient's urine would contain protein but no glucose. What is the evidence in the table to support this? [2]

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(iii) The urine was tested to find out if the doctor was correct.

I. Protein test

State the name of the chemical reagent added to the urine to test for the presence of protein and the colour which would indicate a positive result. [2]

.....

.....

II. Glucose test

When a sample of urine was tested for glucose a chemical reagent was added and the mixture was heated strongly. The colour remained blue showing the doctor to be correct.

Give the name of this chemical reagent and explain how the result would be different if the doctor was incorrect. [2]

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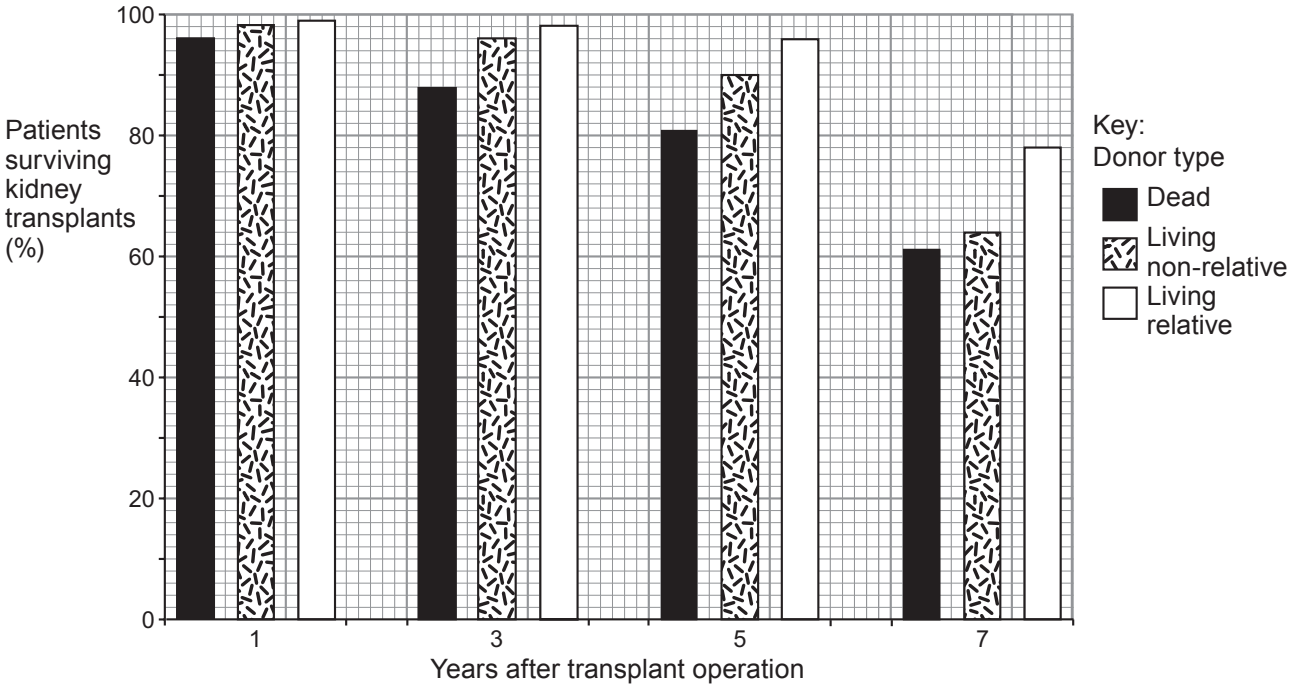
(c) In the case of serious kidney disease a transplant operation can be carried out if a suitable kidney is available from a donor.

The bar chart shows the results of kidney transplant operations with donors of different types. All the recipients and donors were aged 30 – 50 years.



From the bar chart state **three** conclusions that can be drawn to compare the survival of patients after kidney transplant operations with different types of donors. [3]

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(d) Insufficient donor kidneys are available. What other form of treatment can be offered to people with kidney disease? [1]

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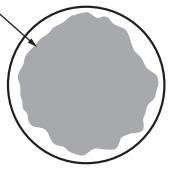
6. *(a)* Describe how you would investigate the effects of two different antibiotics **A** and **B**, on the growth of bacteria. Include examples of aseptic technique in your answer. [6 QER]

You are provided with the following apparatus.

Disinfectant

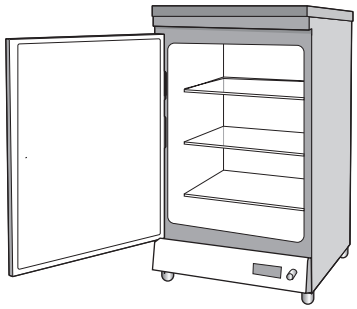
Ready prepared Petri dish containing agar covered in bacteria



Bacteria growing on agar

Filter paper disc soaked in antibiotic **A**

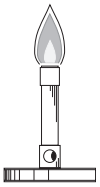
Filter paper disc soaked in antibiotic **B**



Incubator

Adhesive tape

Bunsen burner



Forceps

Marker pen

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(b) The bacterium MRSA is resistant to most antibiotics. State **two** ways in which the spread of MRSA can be reduced. [2]

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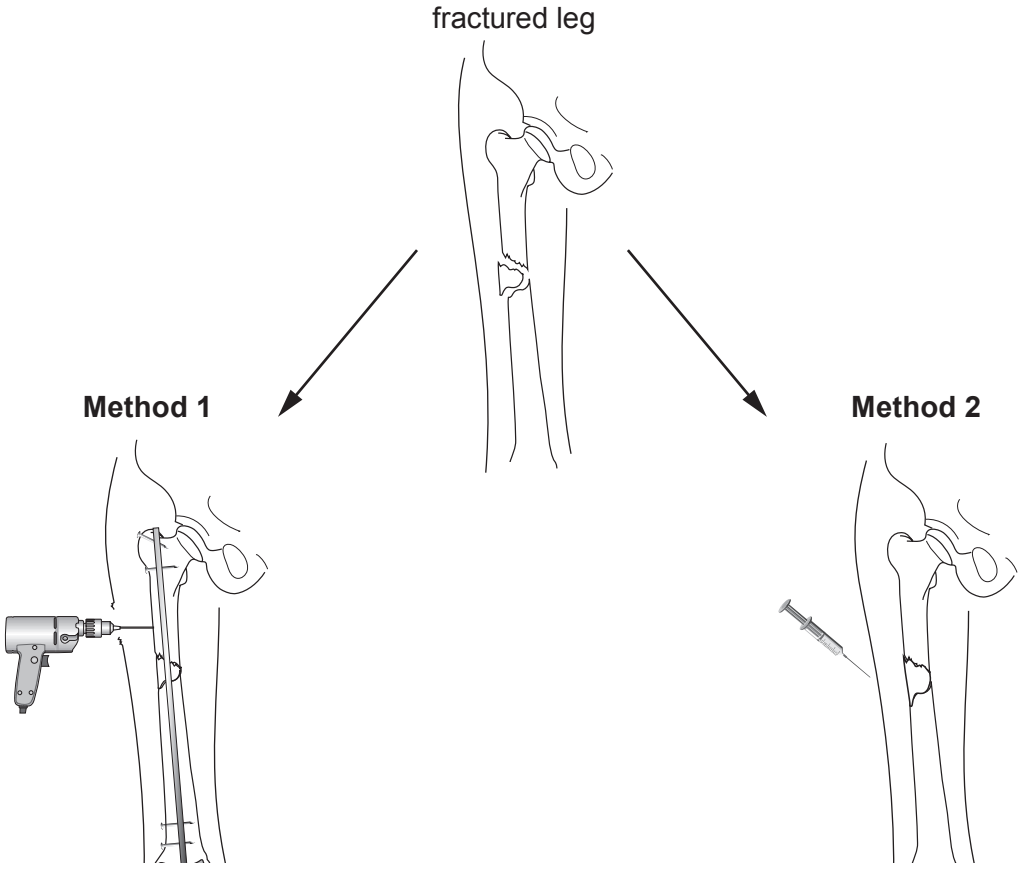
7. The photograph below shows a young ice skater, Tracey, who falls and fractures her leg.

The diagram below shows two ways in which Tracey's fractured leg could be treated in a large modern hospital.



Traditional surgery using a permanent metal rod and screws.

It is possible to stand after 2 days.

A new process which involves injecting stem cells into fractured bone.

It is possible to stand after 3 weeks.

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Expected results of treatment

Time after treatment (weeks)	Percentage of bone healing (%)	
	Traditional surgery	Injection of stem cells
10	10	12
20	14	25
30	19	38
40	28	55
50	41	70
60	59	82

(a) Give **one** reason why Tracey might choose traditional surgery and **one** reason why, alternatively, she might prefer to be treated by an injection of stem cells. [2]

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(b) (i) When fractured bones heal, cells divide and multiply by mitosis.

Complete the table below. [2]

Mitosis in human cells	
chromosomes in mother cell	46
number of daughter cells produced after one division	.....
number of chromosomes in daughter cells	.....

(ii) Following mitosis, what must happen to stem cells, in order for them to repair the fractured bone? [1]

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(iii) State the name of the disease that can occur if cell division by mitosis is uncontrolled. [1]

.....

(c) Stem cells can be obtained from both adults and embryos.

Give **one** reason why some people have a strong personal objection to the use of embryonic stem cells in medical research. [1]

.....

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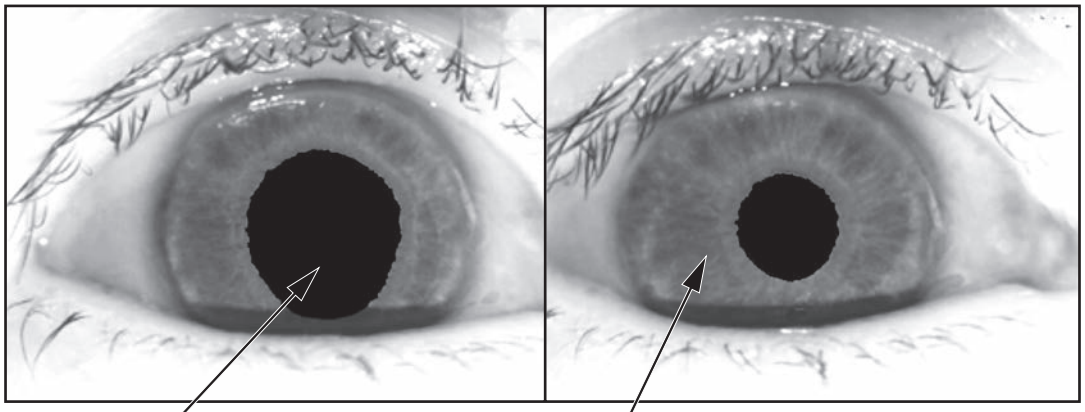
8. The photographs below show the appearance of an eye before and after a reflex action which occurs in response to a change in light intensity.

Before reflex action | After reflex action



A .....

B .....

(a) (i) Label **A** and **B** on the diagram. [1]

(ii) From the photographs, describe how **and** why parts **A** and **B** of the eye alter when the light intensity changes. [3]

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(iii) State **two** features of **all** reflex actions. [1]

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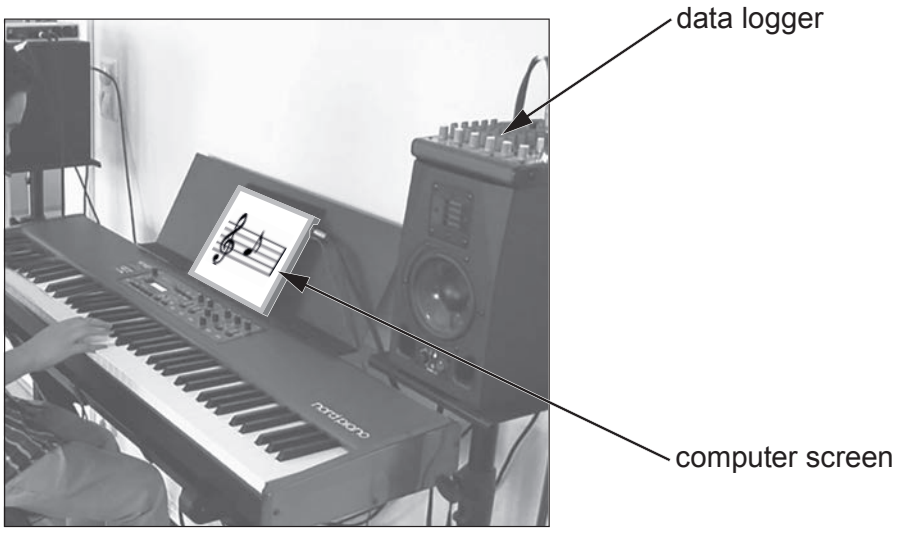
(b) Josie investigated reaction time in humans.

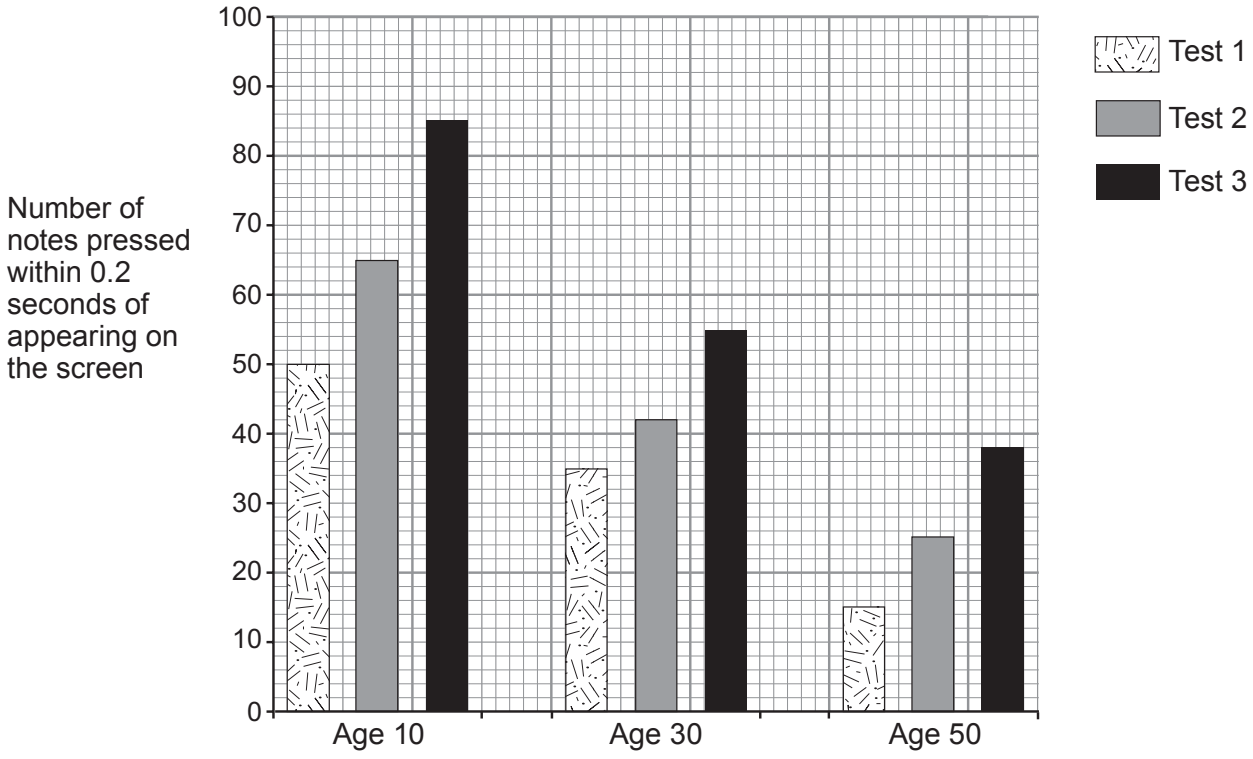
She tested three people, two males and one female of ages 10, 30 and 50 years old. They had between one and 20 years experience of playing the keyboard.

By means of a computer app, 90 random music notes flashed one by one onto a screen. The person being tested then instantly pressed each note on the keyboard as soon as it was seen. Each person did the test three times. No incorrect notes were pressed.

A data logger recorded the number of notes which were pressed within 0.2 seconds of appearing on the screen.



The bar chart shows the results of the investigation.



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Use the bar chart to answer the questions.

(i) How does repeating the test affect reaction time? [1]

.....

(ii) Calculate the percentage change between tests 1 and 2 for age 50. Give your answer to one decimal place. [2]

Percentage change = ... %

(iii) From the data, what **two** conclusions could you make about the effects of age on reaction time? [2]

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(iv) I. Josie decided to try the investigation again and make it a fairer test of the effects of age. State **two** variables which she should control. [2]

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II. State **one** *other* way in which the investigation could be improved. [1]

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