Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 3B: Practical Biology and Research Skills

Tuesday 12 May 2009 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
6BI07/01

You must have:
Ruler, Calculator, HB pencil

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 40.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

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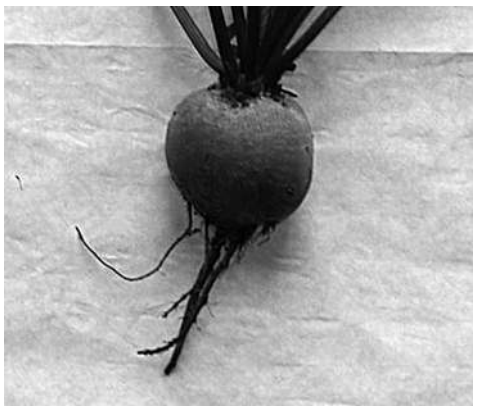
Answer ALL questions

1 The photograph below shows a vegetable called a beetroot. Beetroot cells contain a reddish pigment called betalain. The molecules of this pigment are too large to pass through intact cell membranes. If the membranes are damaged by heating the pigment will leak out of the cells.



Beetroot

An experiment was carried out to investigate the effect of temperature on the cell membranes of beetroot. The following method was used.

Equal-sized cylinders were cut from a beetroot. These cylinders were rinsed in a beaker of distilled water. Labelled boiling tubes, each containing distilled water, were placed into water baths at a range of temperatures and left for a few minutes. A cylinder of beetroot was placed into each of the boiling tubes and left for five minutes. Each cylinder of beetroot was then removed.

The water was now coloured red. The degree of redness was measured.

(a) (i) Explain why it is important to use equal-sized cylinders of beetroot in this experiment.

(1)

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(ii) State the independent variable in this experiment.

(1)

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(iii) The dependent variable in this experiment is the degree of redness. Describe how the degree of redness could be measured.

(3)

(iv) Name **two** other variables in this experiment. In each case, describe how the variable could be controlled.

(4)

1

2

(b) Five students each carried out this experiment and recorded the degree of redness produced at eight different temperatures. Their results are shown in the table below.

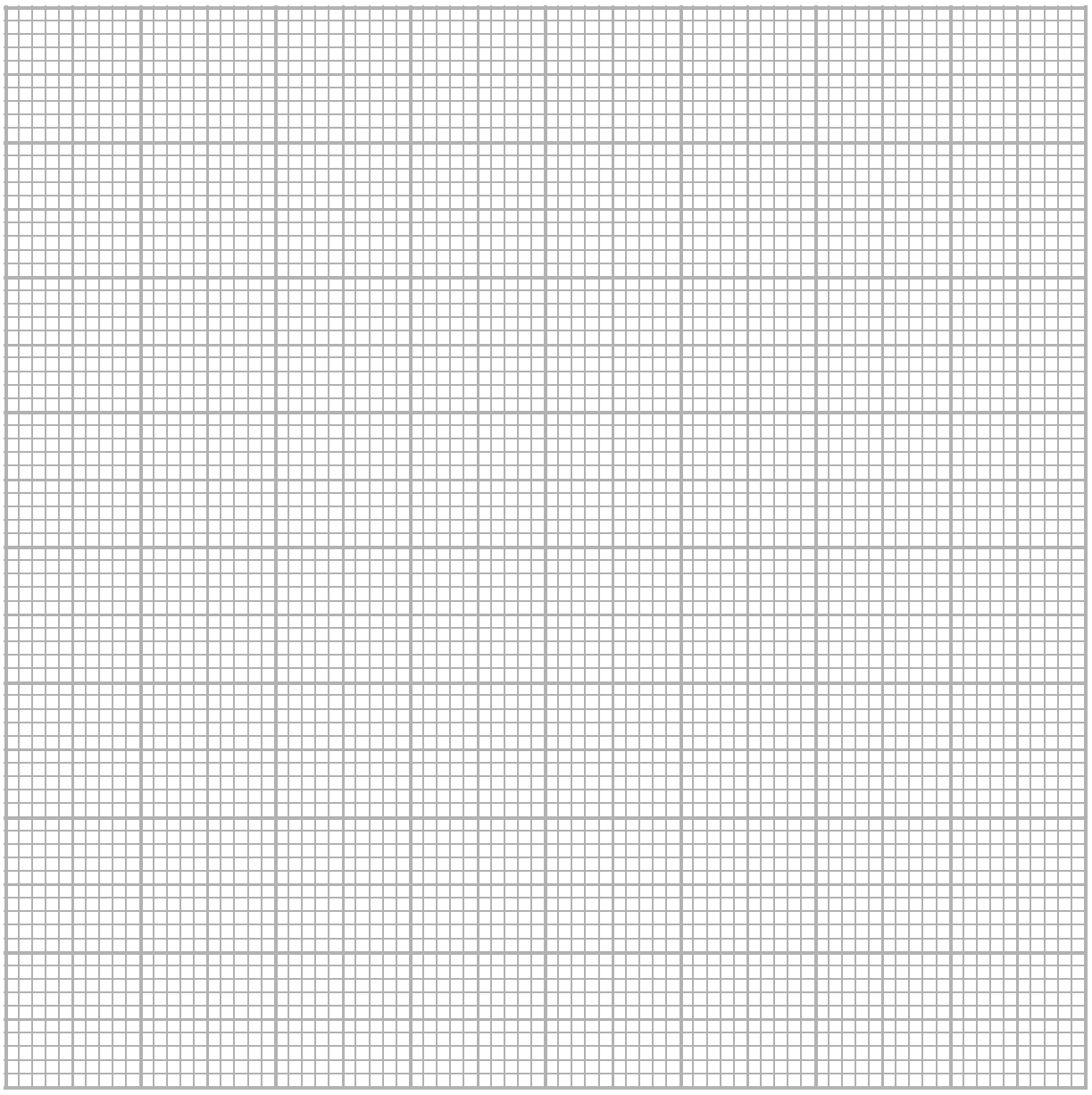
Temperature / °C	Degree of redness / arbitrary units					
	Student 1	Student 2	Student 3	Student 4	Student 5	Mean
0	0.20	0.15	0.30	0.00	0.13	0.16
10	0.00	0.14	0.06	0.03	0.12	0.07
20	0.03	0.08	0.04	0.04	0.02	0.04
30	0.20	0.04	0.04	0.04	0.06	0.08
40	0.18	0.04	0.04	0.04	0.07	0.07
50	0.10	0.26	0.00	0.60	0.18	0.23
60	0.60	0.89	0.80	0.80	0.55	0.72
70	0.75	0.50	0.75	0.75	0.70	

(i) Complete the table by calculating the mean degree of redness at 70 °C. Show your working.

(2)

(ii) Plot the mean values in the table of each temperature in a suitable graphical form.

(4)



(iii) Use the graph to describe and explain the pattern of these results.

(5)

(Total for Question 1 = 20 marks)

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TURN OVER FOR QUESTION 2

2 The following is an extract from a student's report on the topic of genetic testing.

Gene Testing

Tay-Sachs disease is a lethal genetic disorder for which there is no cure. Renee and David Abshire, are both healthy carriers of the allele for this disorder. After they lost one daughter to Tay-Sachs, they decided they would never have another child unless they could be sure that it would be free of the disease. Genetic tests could diagnose the condition before birth, but the Abshires' beliefs ruled out abortion.

Then they learned about a technology called pre-implantation genetic testing (PIGT), used to screen children for cystic fibrosis. Ova and sperm were collected from the Abshires and seven ova were successfully fertilised *in vitro*. When these had developed to the eight-cell stage, a cell was taken from each and the DNA analysed. One showed Tay-Sachs, but three were not even carriers. These three were implanted into Renee and one of these became Brittany who was born in January 1994.

Miracles such as Brittany could become common. An increasing number of fetuses are tested every year as shown by these figures.

Date	Numbers of tests
1989	1854
1990	6114
1991	9310
1992	63 000

Genetic tests can also be used to diagnose illnesses in children and adults. Researchers have found genes associated with Alzheimer's disease, Huntington's disease and breast cancer. Tests based on these and other discoveries could warn people that they are at special risk for those diseases. Used in conjunction with gene therapy that replaces faulty genes with working ones, genetic tests could lead to real cures.

But there are concerns over ethical, legal, social and scientific implications. For example, tests have revealed a large number of people with cystic fibrosis but most of them have only minor respiratory symptoms. These people would never have thought of themselves as genetically ill. Some male patients are healthy except that they are infertile.

It has been shown that cystic fibrosis is not caused by a single type of mutation. Although one mutation is associated with 70 percent of all cases, and two others with another 15 to 20 percent, more than 360 mutations have been linked to cystic fibrosis so far. DNA tests designed to find one mutation will miss others. All these discoveries make it much harder to interpret the results of genetic tests for cystic fibrosis. A positive test result does not indicate how severely afflicted a patient will be, and a negative test result could be misleadingly reassuring.

With this level of uncertainty, it is worrying that in some countries population screening is being attempted. Several screening programmes aimed at detecting genetic diseases in large groups of people have been attempted, some with good results, some with bad.

One example of testing gone wrong is the screening programme for sickle cell anaemia during the early 1970s in the USA. At first, the screening enjoyed popular support. But soon things turned ugly. People were rarely educated about the meaning of the tests, so many perfectly healthy carriers of the trait thought they were sick. This ignorance extended to some state governments as well. Massachusetts passed a law requiring that all children at risk for certain diseases should be screened before enrolment in school.

Some companies began to deny insurance coverage to carriers on the grounds that they had a pre-existing medical condition. The U.S. Air Force Academy rejected applicants who were carriers. Some commercial airlines refused to hire carriers as flight attendants because of the mistaken belief that such individuals were particularly likely to faint at high altitudes. Some prominent scientists suggested on television that the best solution to the sickle cell anaemia problem would be for people carrying the gene to stop breeding. The testing did more harm than good. So, who should know about the results of genetic screening?

An example with greater success is with Tay-Sachs disease. The incidence of Tay-Sachs disease in one group of people is naturally very high (about 1 in every 2 500 births). However, in the USA at least, this has been reduced to virtually zero in about 30 years to the present day. However, the frequency of carriers has not changed over this time.

(a) (i) State **two** ways in which the reduction in the incidence of Tay-Sachs disease in certain groups of people might have been brought about.

(2)

(ii) Nearly all strategies designed to help with genetic disorders have ethical implications. Choose **one** of the methods you have mentioned in (a)(i) and discuss the ethical implications of this method.

(2)

(b) (i) The report lacks diagrams and illustrations. Draw a genetic diagram to illustrate how Tay-Sachs disease was inherited by the Abshires' first daughter. Use **a** to represent the Tay-Sachs allele and **A** to represent the other allele. Suggest, using line numbers, where you would place your diagram in the text. Give an explanation for your answer.

(5)

I would insert this genetic diagram in the report at line number .....

Explanation .....

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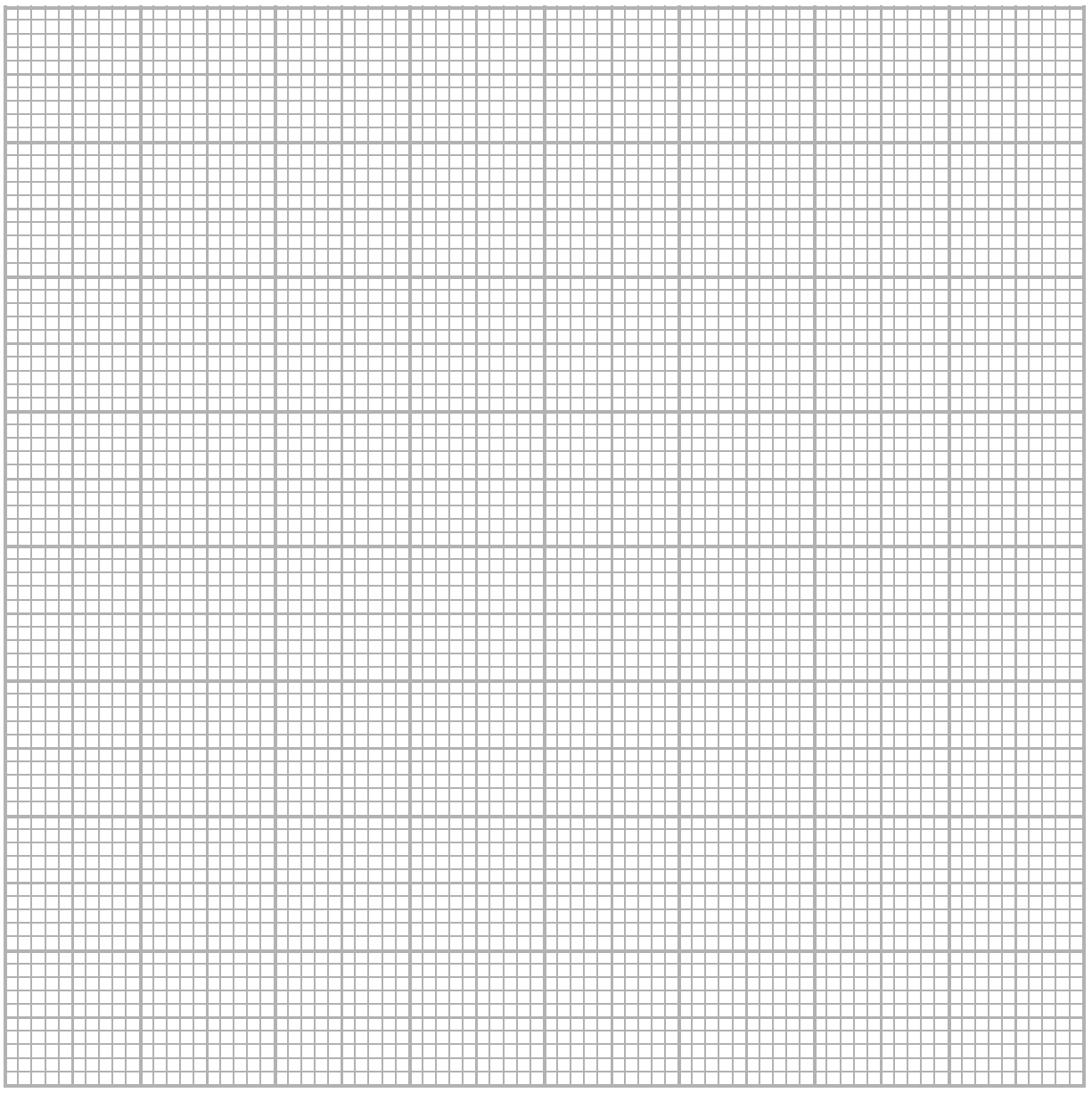
(ii) In the report there is a table (line 18) showing the increase in genetic testing.
Put the data into a suitable graphical form to show the trend.

(3)



(iii) Diagrams A and B give information about genetic testing. For each diagram, write a brief account of what it shows. Suggest where in the report these diagrams should go.

(5)

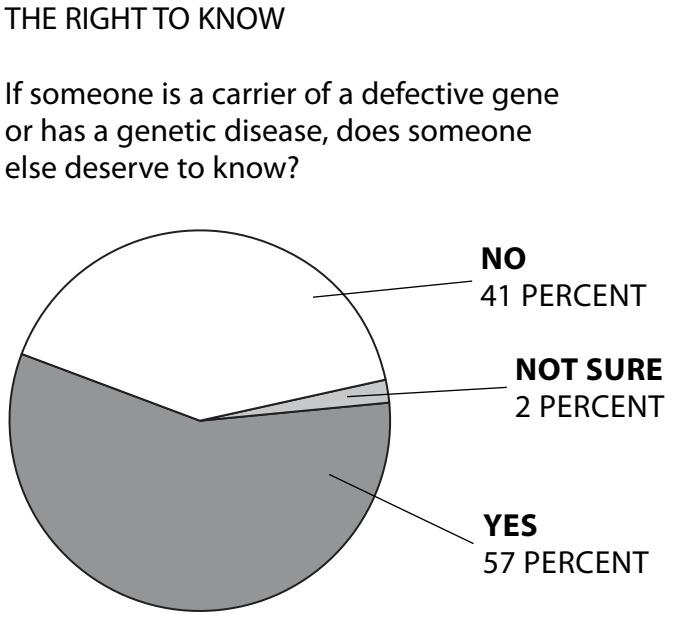


Diagram A

WHO SHOULD KNOW IF THE CARRIER OF A GENETIC DISEASE TRAIT HAS A PRE-EXISTING CONDITION?

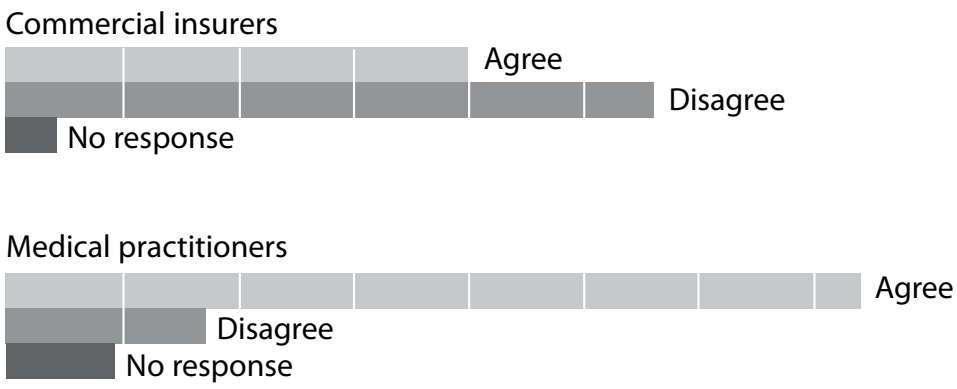


Diagram B

I would insert these diagrams in the report at line number .....

(iv) Make suggestions as to how the information about genetic screening that you have been presented with might be expanded upon. Consider **what** further questions you might want to ask, and **where** you might look for answers.

(3)

What further questions you might want to ask

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Where you might look for answers

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(Total for Question 2 = 20 marks)

TOTAL FOR PAPER = 40 MARKS

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