

General Certificate of Education
January 2008
Advanced Level Examination



GENERAL STUDIES (SPECIFICATION A)
Unit 5 Science, Mathematics and Technology

GSA5

Thursday 24 January 2008 1.30 pm to 3.00 pm

For this paper you must have:

- an objective test answer sheet
 - an 8-page answer booklet
 - a black ball-point pen
 - a ruler.
- You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use a black ball-point pen for recording your answers to Questions 1.1 to 1.20 on your objective test answer sheet.
- Use blue or black ink or ball-point pen for answering **one** question from Questions 2.1 to 2.6.
- Write the information required on the front of your answer book for Question 2. The *Examining Body* for this paper is AQA. The *Paper Reference* is GSA5.
- Answer **all** of Question 1 (1.1 to 1.20) using the answer sheet provided **and one** question from Questions 2.1 to 2.6 in a separate answer book.
- For each item in Question 1 there are several alternative responses. When you have selected the response which you think is the best answer to a question, mark this response on your answer sheet.
- Do all rough work in your answer book, **not** on your answer sheet.

Information

- The maximum mark for this paper is 45.
- This paper consists of **two** questions.
Question 1 contains 20 objective test questions based on a variety of exercises in spatial and mechanical relations. Each question carries 1 mark. You will not lose marks for wrong answers.
Question 2 consists of six alternative essay questions (2.1 to 2.6). 25 marks are available for your essay.

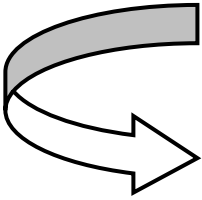
QUESTION 1

Answer **Questions 1.1 to 1.20**.

For each of **Questions 1.1 to 1.20** choose the answer represented by the letter **A, B, C** or **D** that you think best.

Questions 1.1 to 1.7**Image Manipulation**

The 'Draw' function in a computer program provides a library of autoshapes. 'Block Arrows' is one set of autoshapes. It includes the following shape.



If the 'Rotate or Flip' instruction is selected the following menu appears.



Rotate Left



Rotate Right



Flip Horizontal



Flip Vertical

The black shapes show the effect of the instruction on the original white shapes.

Each instruction may be repeated any number of times.

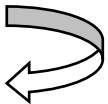
Questions 1.1 to 1.4

For each of **Questions 1.1 to 1.4** consider the following shape as the original image.

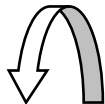


1.1 After one 'Rotate Left' instruction the outcome on the above autoshape is

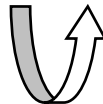
A



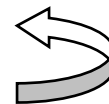
B



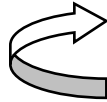
C



D



1.2 The outcome shown below is the result of



- A** a 'Flip Vertical' instruction.
- B** a 'Flip Horizontal' instruction.
- C** two 'Rotate Left' instructions.
- D** a 'Rotate Right' instruction.

1.3 Two consecutive 'Rotate Left' instructions have the same result as

- A** two 'Flip Vertical' instructions.
- B** two 'Rotate Right' instructions.
- C** four 'Flip Vertical' instructions.
- D** four 'Rotate Right' instructions.

1.4 Which of the following combinations of instructions result in the autoshape moving back to its starting position?

- 1** One 'Rotate Right' instruction followed by one 'Rotate Left' instruction
- 2** Two 'Rotate Right' instructions
- 3** Four 'Rotate Left' instructions
- 4** Four 'Rotate Right' instructions

Answer

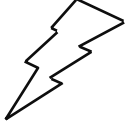
- A** if **1** alone is correct.
- B** if **2** alone is correct.
- C** if **3** and **4** only are correct.
- D** if **1**, **3** and **4** only are correct.

Turn over ►

1.5 A 'Flip Horizontal' instruction on the following shape will give the image



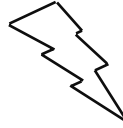
A



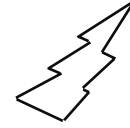
B



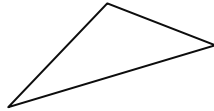
C



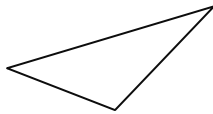
D



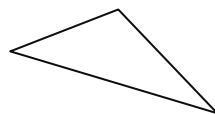
1.6 A 'Flip Horizontal' followed by a 'Flip Vertical' instruction on the following shape will give the image



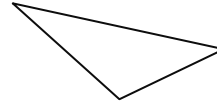
A



B



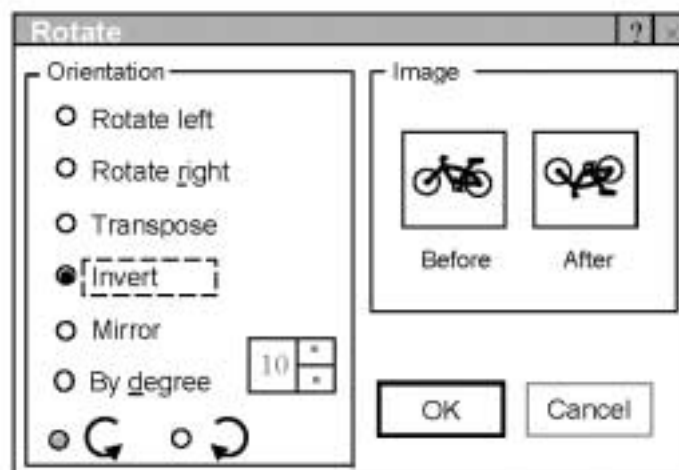
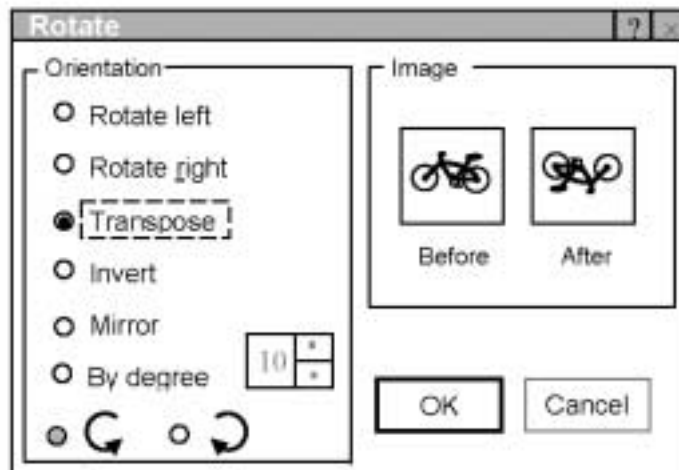
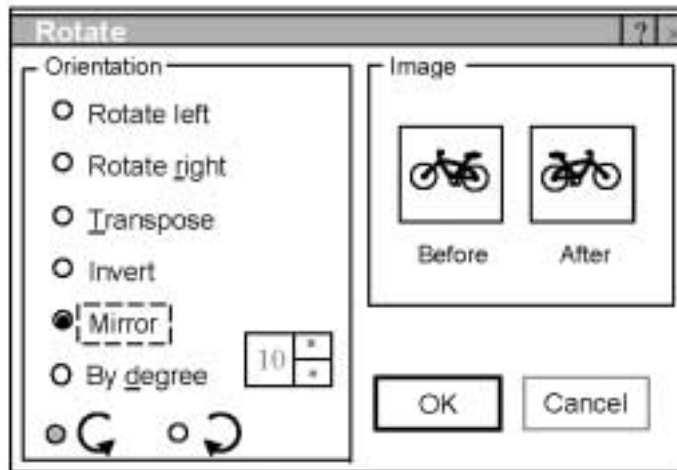
C



D



1.7 Another computer drawing program has the following functions.



Each of the following statements is true **except**

- A 'Mirror' is the same as a 'Flip Horizontal' instruction.
- B 'Invert' is the same as a 'Flip Vertical' instruction.
- C 'Transpose' is the same as a 'Flip Horizontal' followed by a 'Flip Vertical' instruction.
- D 'Invert' is the same as two 'Rotate Right' instructions.

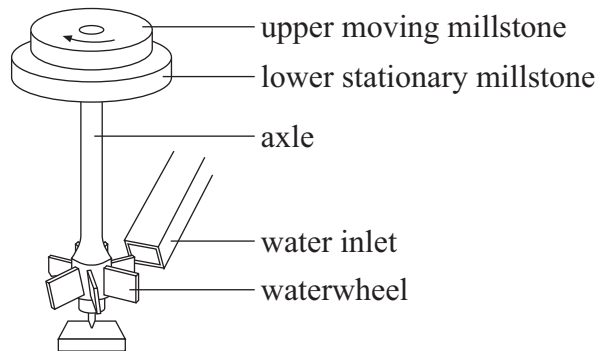
Turn over ►

Questions 1.8 to 1.13

Mills

Figure 1 shows the earliest water mill arrangement. A waterwheel directly drives an upper moving millstone, which grinds on a lower stationary millstone.

Figure 1: Greek or Norse Mill



1.8 In **Figure 1** the rotation rate and direction of the upper stone compared to the waterwheel is

- A** half the speed and in the same direction.
- B** twice the speed but in the opposite direction.
- C** the same speed and in the same direction.
- D** the same speed but in the opposite direction.

1.9 The arrangement shown in **Figure 1** could be described as

- A** horizontal waterwheel, horizontal axle.
- B** horizontal waterwheel, vertical axle.
- C** vertical waterwheel, horizontal axle.
- D** vertical waterwheel, vertical axle.

Figure 2 is a drawing of a Roman Mill, an improvement on the Greek or Norse Mill. There is now a vertical waterwheel but the millstones stay where they were in the earlier mill. A man is seen feeding corn into a hopper that feeds the corn into the millstones and a second man is seen collecting flour at ground level.

In the Roman Mill, the transmission of power through a right angle is achieved using a lantern.

Figure 3 shows the lantern in isolation. This lantern also acts as a gear to make the upper moving millstone speed up compared with the waterwheel. The gear ‘teeth’ are wooden pegs that mesh with holes in the wooden cage.

Figure 2: Drawing of a Roman Mill

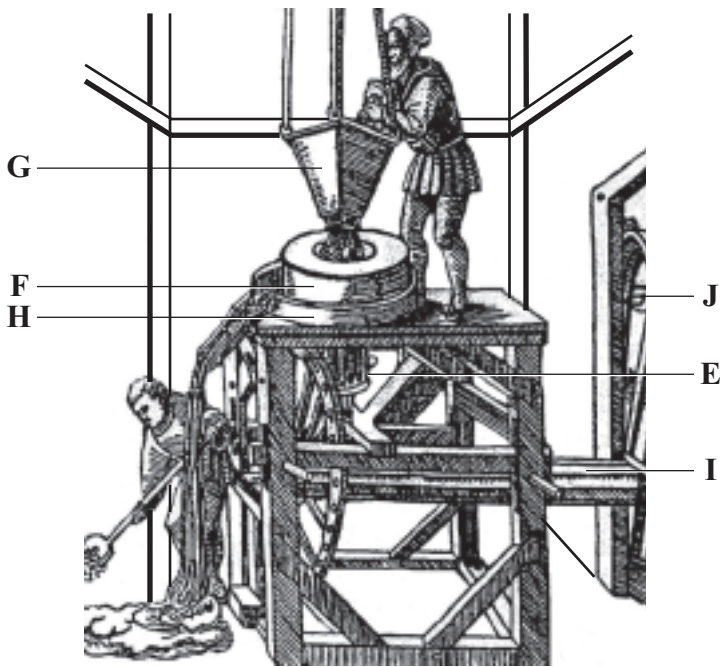
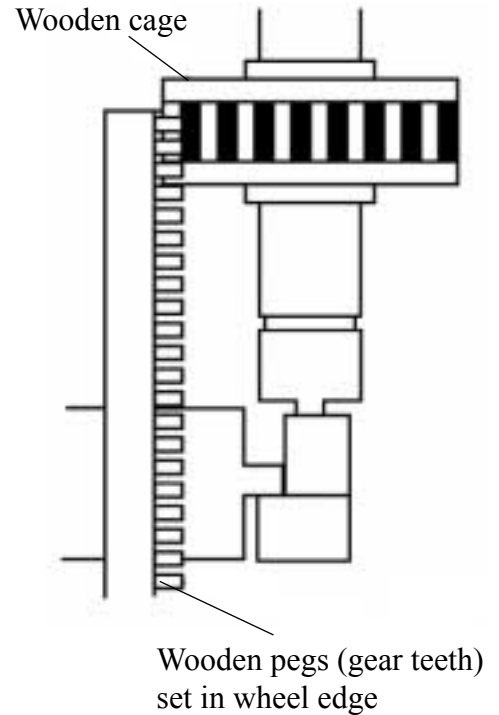


Figure 3: The Lantern



1.10 In the Roman Mill the rotary motion of the waterwheel has been turned through

- A 45°
- B 90°
- C 180°
- D 360°

1.11 In **Figure 2** the waterwheel is labelled

- A E
- B F
- C H
- D J

1.12 In **Figure 2** the waterwheel axle is labelled

- A E
- B F
- C I
- D J

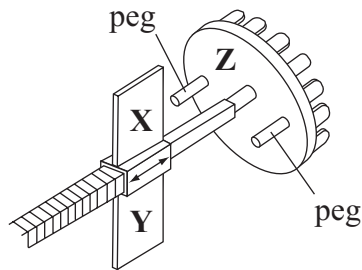
1.13 The part in **Figure 2** which makes the upper millstone rotate faster than the waterwheel is labelled

- A E
- B F
- C I
- D J

Turn over ▶

If it takes time for a wheel to reach full speed when starting, it is best to disconnect the machinery at first. **Figure 4** (an early clutch) shows a device to do this.

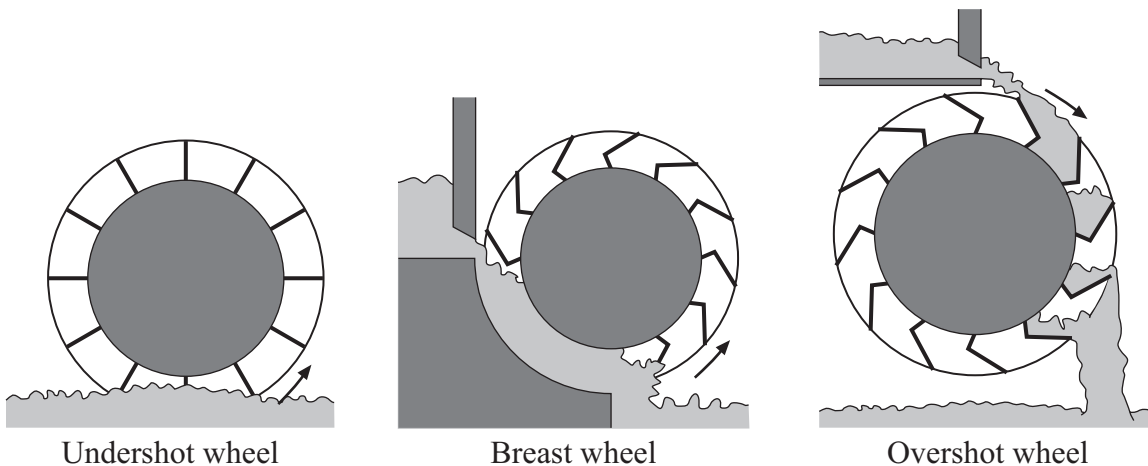
Figure 4: Clutch



1.14 To engage the load, the paddles **X** and **Y** (**Figure 4**) have to be moved

- A** away from **Z** to be released from the pegs.
- B** away from **Z** to engage the pegs.
- C** towards **Z** to be released from the pegs.
- D** towards **Z** to engage the pegs.

Figure 5: Different types of vertical waterwheels



There are three main ways for the water to hit a vertical wheel. **Undershot** uses fast moving water to hit flat paddles; **breast** and **overshot** use the weight of the water as it collects in bucket shaped paddles.

1.15 The type of wheel which uses **mainly** the kinetic energy of the water to turn the wheel is

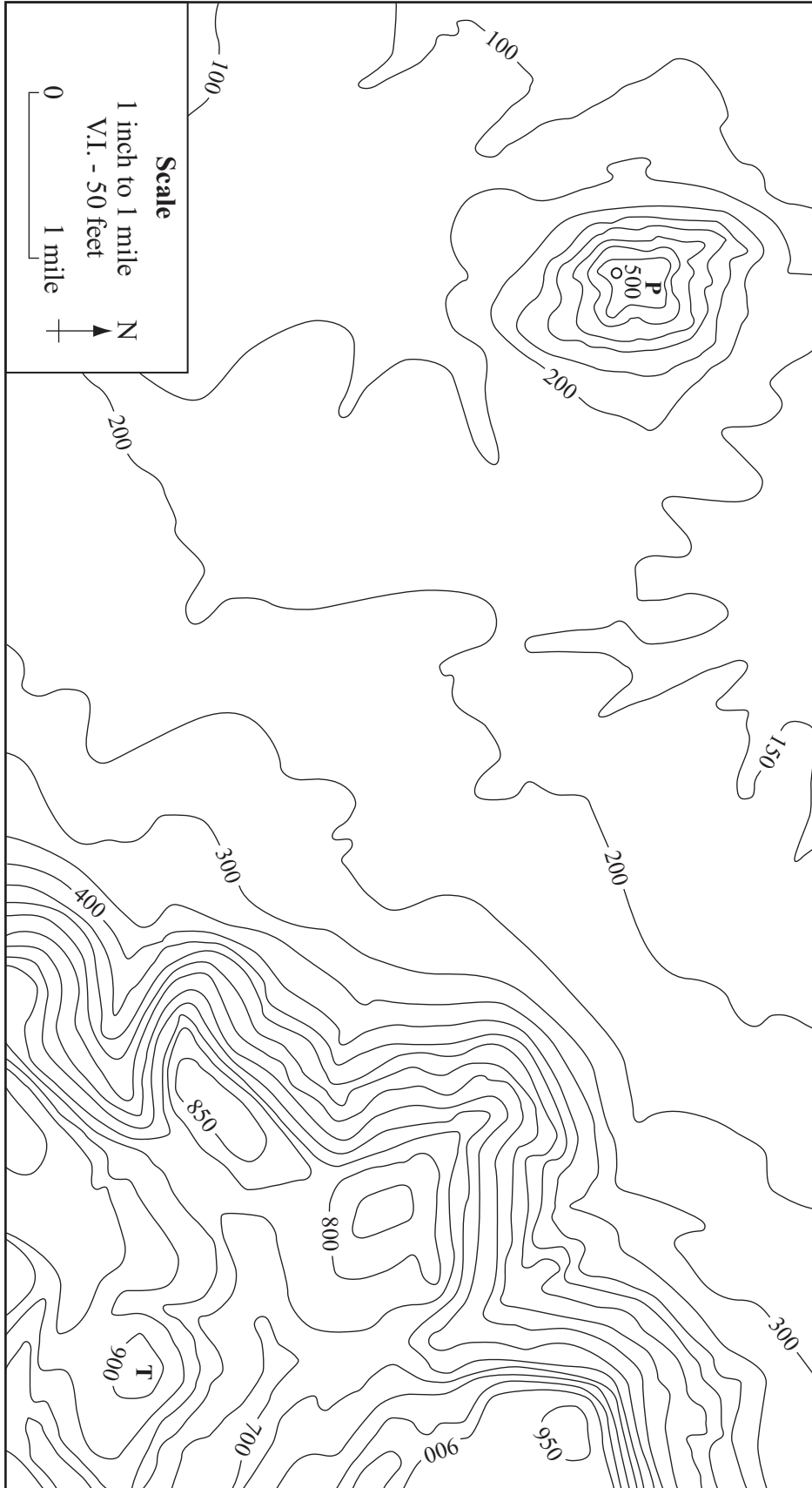
- A** the undershot wheel.
- B** the breast wheel.
- C** the overshot wheel.
- D** all three types of wheel.

Turn over for the next question

Turn over ▶

Questions 1.16 to 1.20**Relief Map and Contours**

An old relief map of a hilly region is provided below. V.I. stands for vertical interval and shows that the vertical distance between adjacent contours is fifty feet. The scale of this map is one inch to one mile.



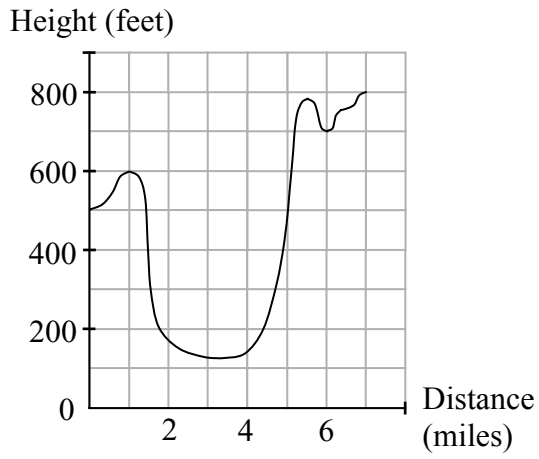
- 1.16** The area of land covered by the map is approximately
- A** 25 square miles.
 - B** 35 square miles.
 - C** 45 square miles.
 - D** 60 square miles.
- 1.17** The average gradient between **P** and **T** is approximately fifty feet in
- A** half a mile.
 - B** one mile.
 - C** two miles.
 - D** three miles.
- 1.18** The effect of changing the scale of the map from one inch to one mile to half an inch to one mile would be
- A** to bring the contours closer together.
 - B** to separate the contours further.
 - C** no change on contour separation.
 - D** to halve the area of the mapped region.
- 1.19** The effect of altering the map so that only the one hundred feet contours are shown would be to
- A** make the terrain less hilly.
 - B** reduce the average gradients shown.
 - C** make horizontal distance more difficult to measure.
 - D** provide less detail of relief changes.

Turn over for the next question

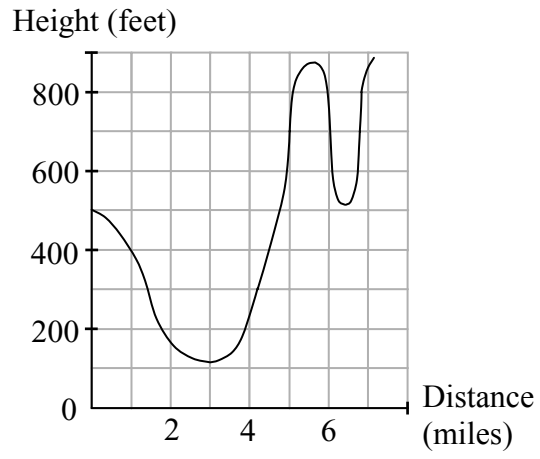
Turn over ►

1.20 The altitude profile when a straight section is taken from **P** to **T** is best represented by

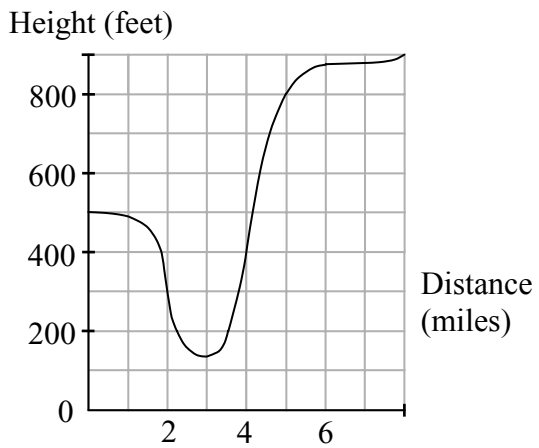
A



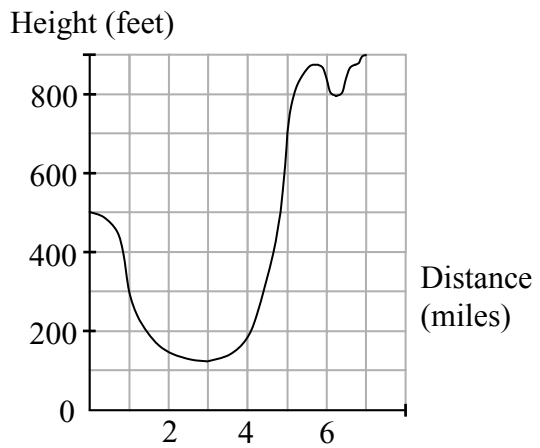
B



C



D



END OF QUESTION 1

QUESTION 2

Answer **one** of Questions **2.1** to **2.6**.

There are 25 marks for each question.

Answer this question in a **separate** answer book. Label this answer book **GSA5 Question 2**.

Where appropriate include relevant science and use examples to illustrate your answer.

Write your answer in continuous prose as if you are addressing the intelligent general reader. You will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

- 2.1** Explain the differences between organic agriculture and conventional agriculture. Identify and assess reasons for the increasing popularity of organic food.
- 2.2** Explain how electricity is generated by hydro-electric power stations. Discuss the advantages and disadvantages of hydro-electric power generation for the environment and for society.
- 2.3** Explain how the scientific method can contribute to the detection and solution of crime. Consider in detail at least two areas of forensic science or technology that are commonly used in the collection and interpretation of evidence.
- 2.4** Explain the causes and effects of earthquakes. Discuss the extent to which it is possible to limit damage to life and property as a result of earthquakes and related natural phenomena.
- 2.5** Explain the process of in-vitro fertilisation (IVF) and identify the circumstances in which it might be used. Discuss the scientific and ethical issues arising from the development and use of IVF.
- 2.6** “There is no alternative medicine. There is only medicine that works and medicine that doesn’t work.” (Professor Richard Dawkins)
Discuss the differences between ‘alternative medicine’ and conventional medicine.

END OF QUESTIONS

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