

General Certificate of Education
January 2006
Advanced Level Examination



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

GSA5

Wednesday 25 January 2006 1.30 pm to 3.00 pm

For this paper you must have:

- an objective test answer sheet
- an 8-page answer book
- a black ball-point pen

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.
- Hand in **both** your answer sheet **and** your essay answer book at the end of the examination.

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. No deductions will be made for wrong answers.
- **Question 2** consists of six alternative essay questions (2.1 to 2.6). 25 marks are allocated to your essay.

QUESTION 1

Answer **Questions 1.1 to 1.20.**

For each of **Questions 1.1 to 1.20** choose the answer you consider the best of the alternatives offered in **A, B, C and D.**

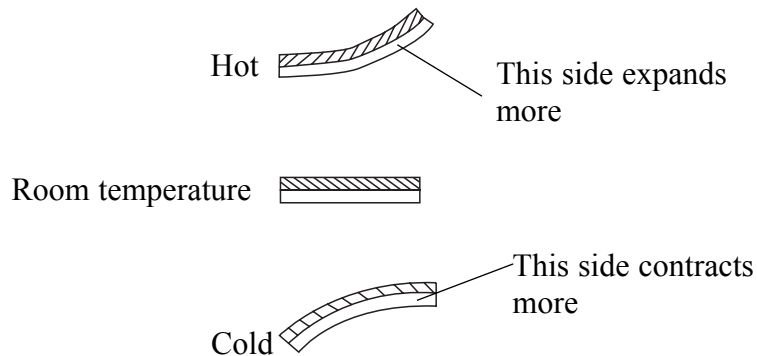
Questions 1.1 to 1.5 and their respective sources, have not been reproduced here due to third-party copyright constraints.

Questions 1.6 to 1.7

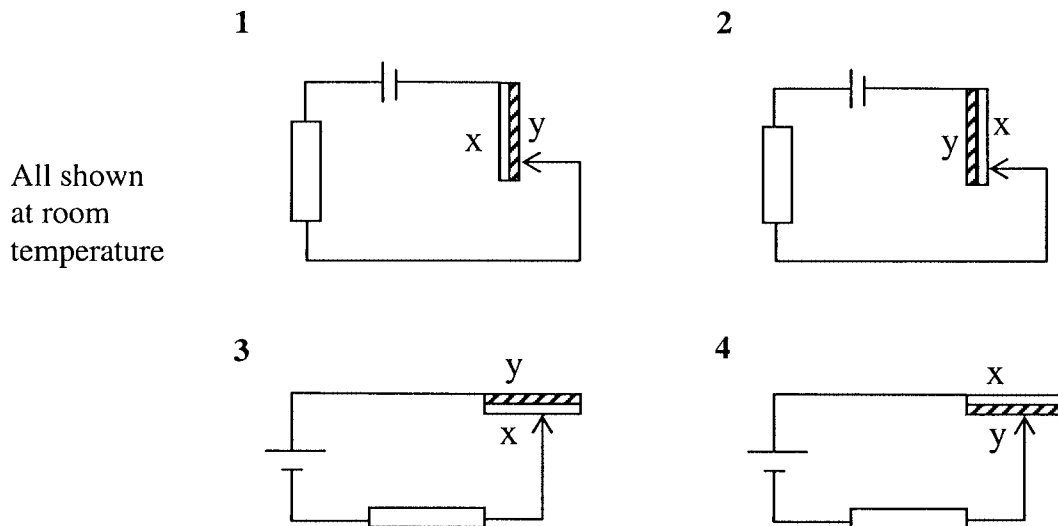
Bi-metal Strips

Many control devices use the expansion of metals to sense temperature. If two strips of different metals are fixed firmly together and one metal expands more than the other, the whole strip bends so that the longer strip is on the outside of the curve. This is called a bi-metal strip. The metal which expands the most will also contract the most if the temperature falls.

Figure 3



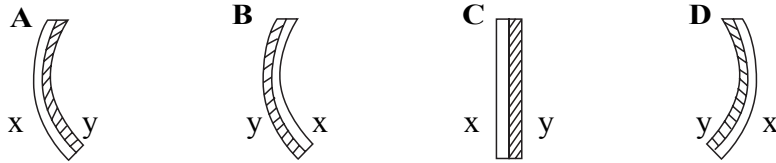
- 1.6** X expands more than Y for the same temperature rise. X and Y are joined in a bi-metal strip and used to switch off a heating circuit when the strip reaches the required temperature. The circuit(s) which is (are) assembled to do this correctly are:



Answer

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

1.7 The same bi-metal strip as used in **Question 1.6** is put into a freezer. When it is cold it might look like



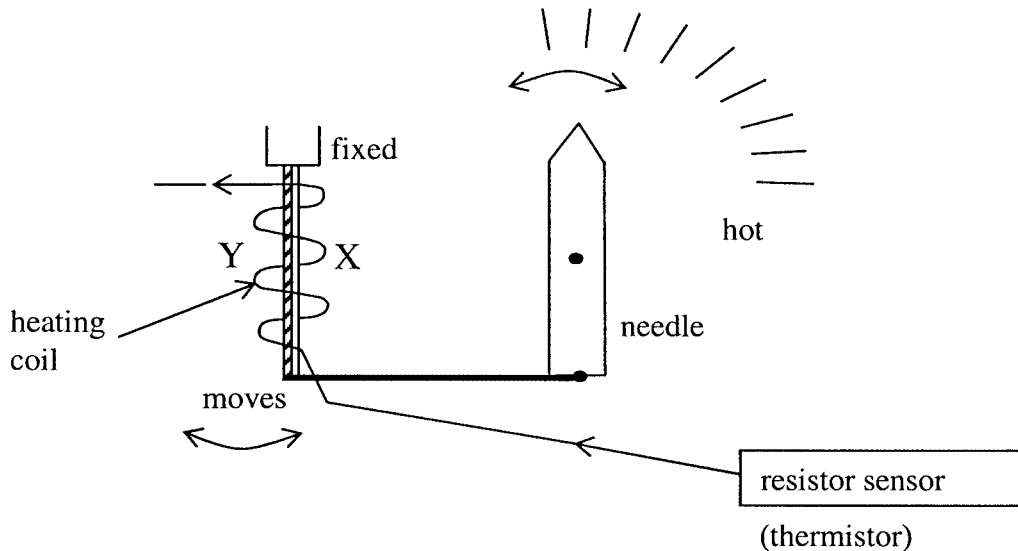
Turn over for the next question

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Questions 1.8 to 1.11

Another device that may use a bi-metal strip is the water temperature gauge in a car. This is shown in **Figure 4**. A resistor whose resistance drops with increasing temperature (a thermistor) is used as a sensor in the water. Current flows through the thermistor and on through a heating coil around the bi-metal strip. The current in a circuit is altered by this. The bi-metal strip is heated by the current flowing in the coil around it.

Figure 4



1.8 When the water is hot the

- A resistance is low and the current is low.
- B resistance is low and the current is high.
- C resistance is high and the current is low.
- D resistance is high and the current is high.

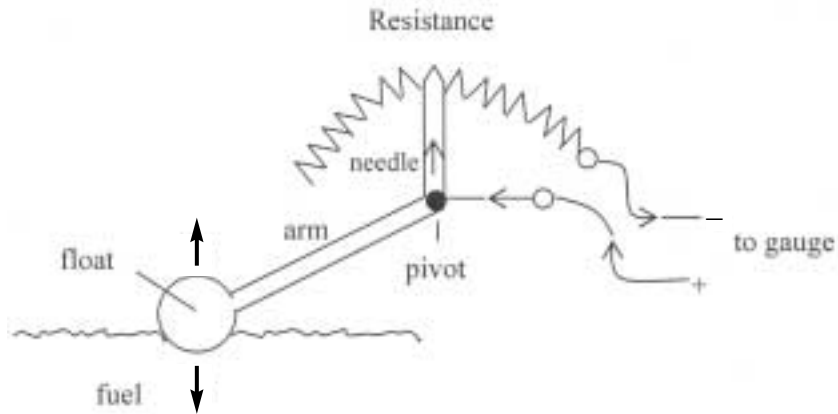
1.9 X expands more than Y for the same rise in temperature. When the strip gets hot it will bend

- A to the left.
- B to the right.
- C out of the page.
- D into the page.

1.10 If the strip bends to the left, the needle will then move

- A anticlockwise.
- B clockwise.
- C out of the page.
- D into the page.

- 1.11** Some measuring devices use a motion to move a slider on a resistance. In this example the current flows along the needle which is at a fixed angle to the arm of the float. The tip of the needle makes electrical contact on the resistance. The current is converted into a reading on the dial of the fuel gauge on the car dashboard.



As the float moves up the lever moves


- A to the right, increasing the current.
- B to the right, decreasing the current.
- C to the left, increasing the current.
- D to the left, decreasing the current.


Turn over for the next question



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Questions 1.12 to 1.20

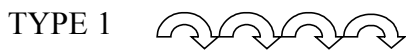
Frieze patterns


Frieze patterns are made by repeating a motif such as  continuously in the same direction.

The motif can be repeated by simple translation  or by first using another transformation such as a 180° rotation, or a reflection parallel or perpendicular to the direction of the frieze to create a new basic block then translating the combined result.

In the following example the motif has undergone a 180° rotation to create a new basic block  of two motifs, which is then repeated by translation .

There are just seven different types of frieze pattern.



1.12 The original basic motif  is made into a printing block.
How many of the seven types of frieze pattern could be printed using only this block?

- A 1
- B 2
- C 3
- D 7

1.13 Which of the following types of frieze pattern is generated by first reflecting the original basic motif, then rotating the resulting new two-motif block, then translating the resulting four-motif block?

- A Type 3
- B Type 4
- C Type 5
- D Type 7

1.14 In the sample of pattern Type 6 shown above, how many times is the basic block used by translation?

- A** 1
- B** 3
- C** 6
- D** 12

1.15 Considering frieze patterns of Type 3, 4 and 5, which of these use reflection in a mirror line at right angles to the line of the frieze?

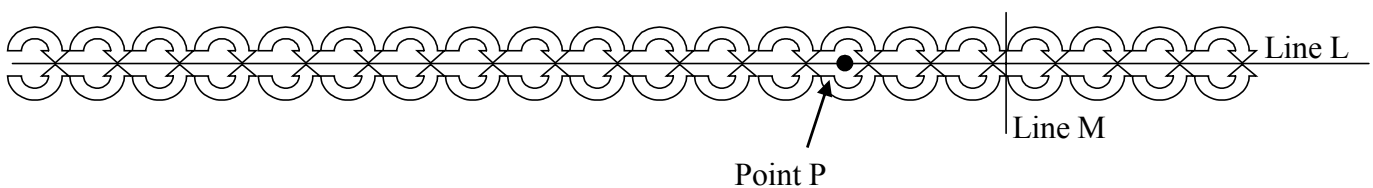
Answer

- A** if Type 4 alone is correct
- B** if Type 5 alone is correct
- C** if Type 3 and 4 only are correct
- D** if Type 3, 4 and 5 only are correct

1.16 Which of the seven types of frieze pattern can be generated using reflections both parallel to the line of the frieze and perpendicular to the line of the frieze?

- A** Type 3
- B** Type 4
- C** Type 5
- D** Type 6

1.17 Here is the Type 5 pattern. Assume that it continues without end.



Which of the following transformations leave(s) the pattern unchanged?

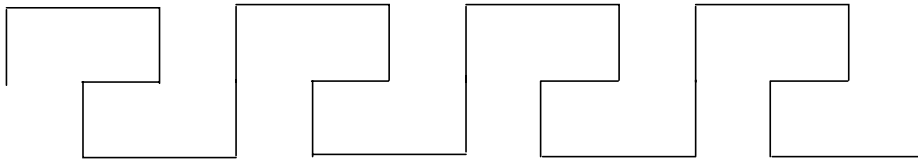
- 1** a reflection in Line L
- 2** a reflection in Line M
- 3** a half-turn rotation about Point P

Answer

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

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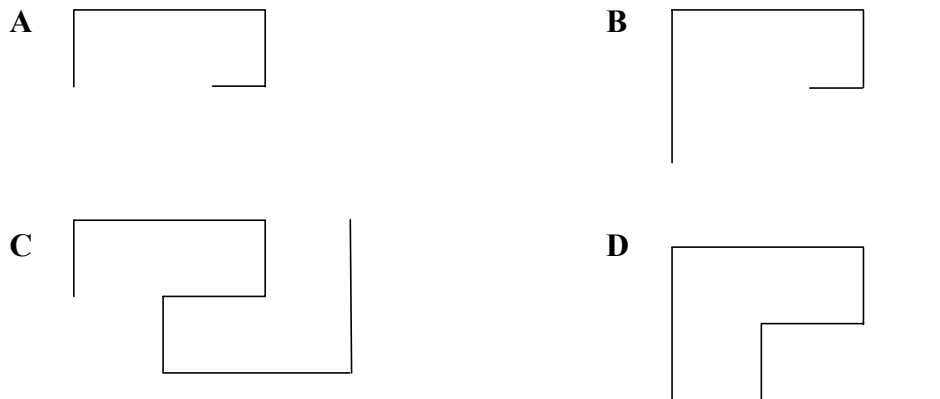
1.18 The well-known 'Greek Key' design is a frieze pattern.



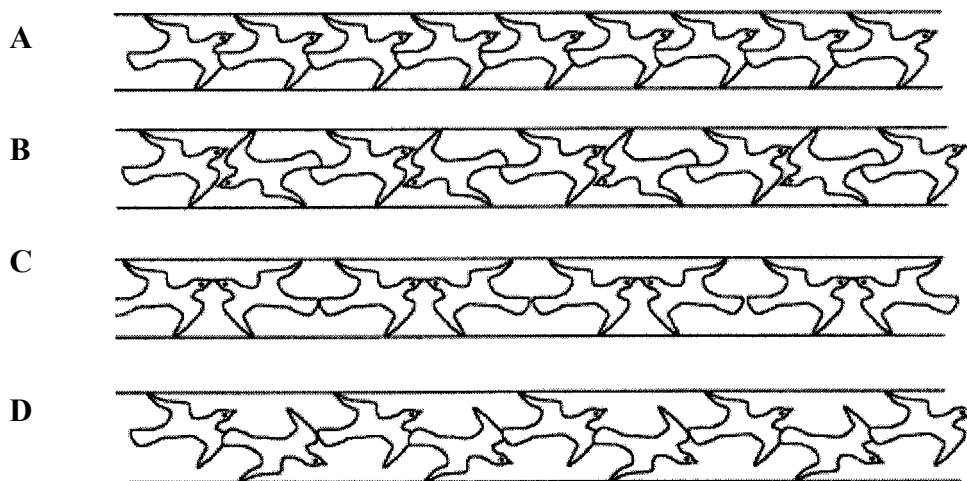
Which one of the following types of frieze pattern is this?

- A Type 2
- B Type 3
- C Type 6
- D Type 7

1.19 A basic motif without the need for overlap for the Greek Key pattern is



1.20 Here are four frieze patterns generated using a bird motif.
Which one of these patterns could be generated using reflections only?



QUESTION 2

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

Each question carries 25 marks.

This question must be answered in a **separate** answer book which must be clearly labelled **GSA5 Question 2**. Include relevant science wherever appropriate.

Write your answer in continuous prose as if you are addressing the intelligent general reader. You are reminded of the need for good English and clear presentation in your answer. Quality of Written Communication will be assessed in this answer.

2.1 Discuss the extent to which technology, vehicle design and laws affecting road users have each contributed to personal safety and health.

2.2 Explain how electrical energy can be obtained from fissile material.

Discuss the extent to which the world needs nuclear energy for power production.

2.3 Explain the science that enables human organ transplants.

Should there be a law of presumed consent regarding organ donation? Give reasons to support your answer.

2.4 Explain how a scientific experiment could be designed to field test the effectiveness of a new pesticide spray for cabbages.

What concerns would need to be addressed for the experiment to be considered valid and reliable?

2.5 With reference to one or more specific areas of the countryside, examine the conflicts that might arise amongst industrial, commercial and recreational uses.

Discuss the extent to which science and technology might reconcile conservation and preservation with the economic and social needs of society.

2.6 In the last twenty-five years food scares have been a feature of mass food production.

Discuss the scientific and hygiene conditions that have given rise to these food scares and how such scares might be avoided in the future.

END OF QUESTIONS

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