

General Certificate of Education  
January 2005  
Advanced Level Examination



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

**GSA5**

Tuesday 25 January 2005          Afternoon Session

**In addition to this paper you will require:**

- 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.

**Advice**

- Do not spend too long on any item in Question 1. If you have time at the end, go back and answer any question you missed out.

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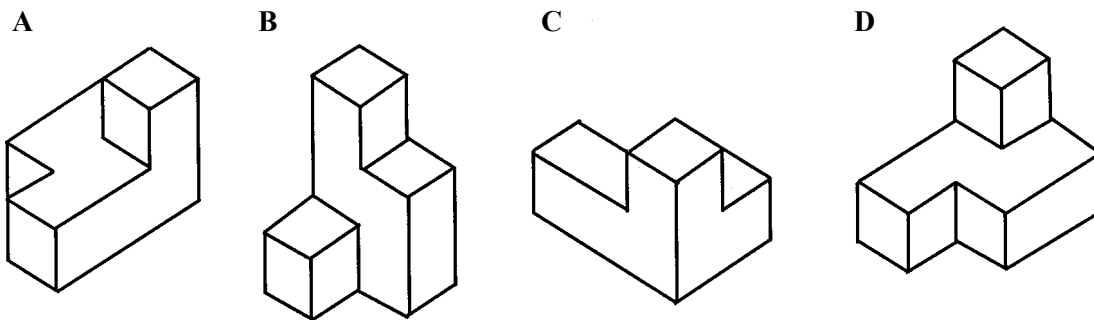
**QUESTION 1**
**Answer Questions 1.1 to 1.20**


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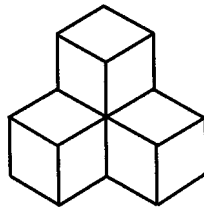
For each of Questions 1.1 to 1.20 choose the answer you consider the best of the alternatives offered in A, B, C and D.

**Questions 1.1 to 1.7**
*Spatial Geometry*

1.1 One of these solid shapes is the reflection of the other three. Which shape is it?


**Questions 1.2 to 1.3**

The diagram below shows a solid made from four one centimetre cubes.



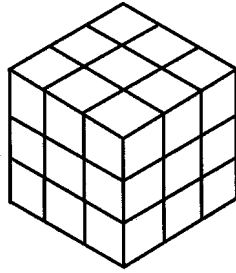
1.2 What is its surface area?

- A  $3 \text{ cm}^2$
- B  $9 \text{ cm}^2$
- C  $18 \text{ cm}^2$
- D  $24 \text{ cm}^2$

1.3 How many different five-cube solids can be made by adding another cube face-to-face?

- A 1
- B 2
- C 3
- D 4

1.4 The cube below is made up of 27 one centimetre cubes. The outside of the large cube is painted.

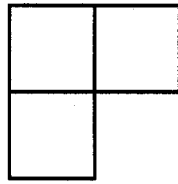


The number of one centimetre cubes with **just** two faces painted is

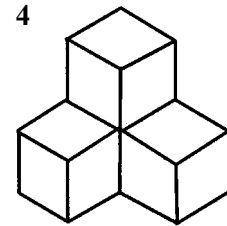
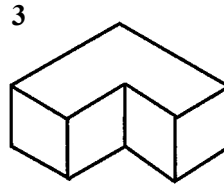
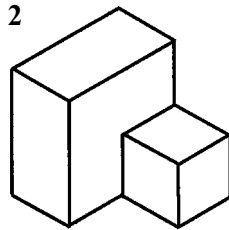
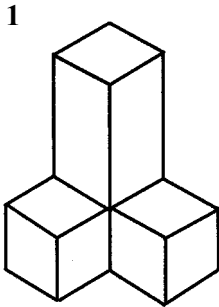
- A 3
- B 6
- C 8
- D 12

**TURN OVER FOR THE NEXT QUESTION**

1.5 This diagram is the plan view of one or more of the shapes shown below.



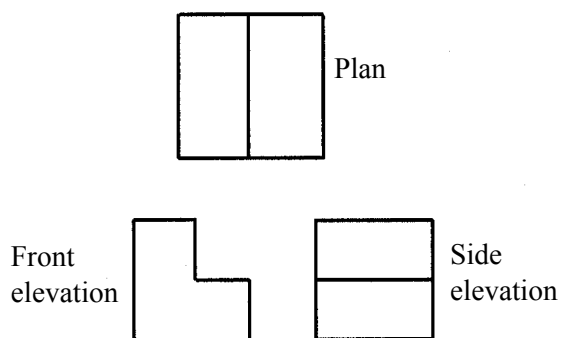
Which of the isometric drawings below represent shapes with this plan view?



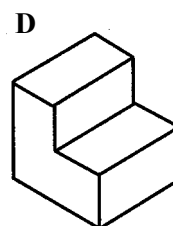
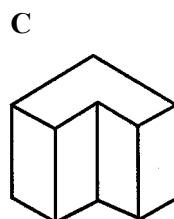
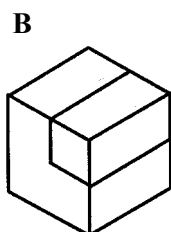
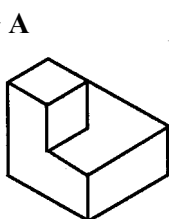
Answer

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

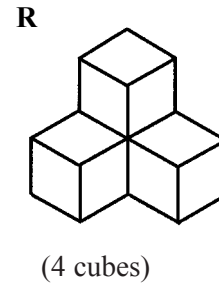
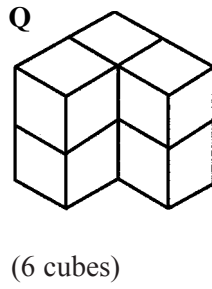
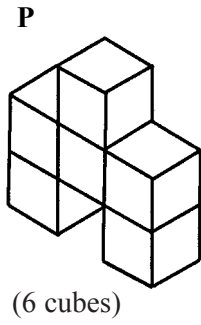
1.6 The diagrams show the plan view and the front and side elevations of a solid.



The isometric drawing of this solid is



1.7 Which of these shapes can be put together with identical shapes to fill space completely?



Answer

- A if all can fill space.
- B if only **R** can fill space.
- C if only **P** can fill space.
- D if only **P** and **Q** can fill space.

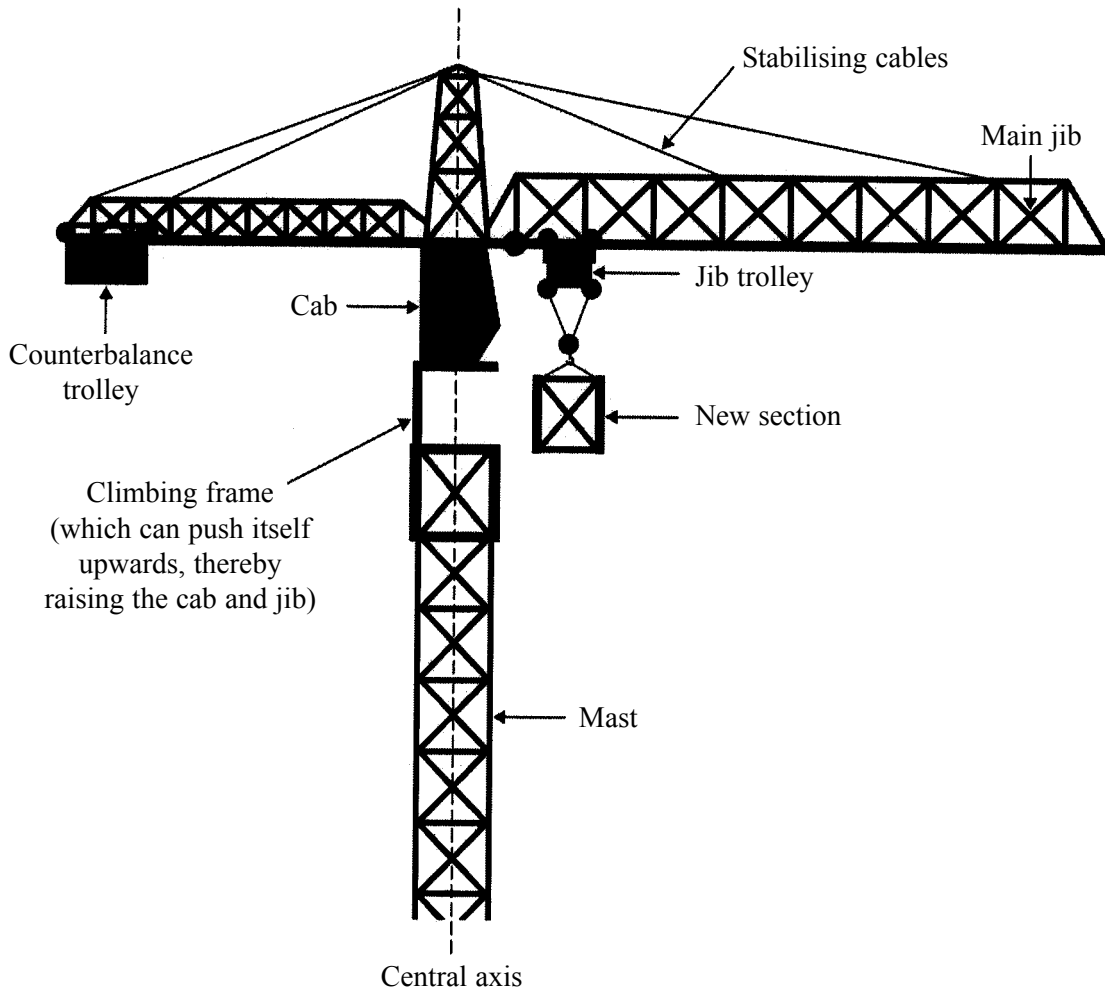
**TURN OVER FOR THE NEXT QUESTION**

### Questions 1.8 to 1.13

#### *Tower Crane*

The tower crane is built by placing the jib structure and cab on top of a climbing frame, slightly larger than a standard section of mast. All is placed on a rotating base. This takes about a day. The climbing frame lifts itself, the cab and jib structure leaving room for another modular section of the mast to be added to the tower crane itself. It takes about a day to build three mast sections of the tower crane at a time.

Each mast section is 3 m high and the tower crane is to operate with a height of 75 m.



**Figure 1: Tower Crane**

- 1.8** Given the information in the text of Figure 1, the total amount of time needed to build the crane is approximately
- A** one week.
  - B** ten days.
  - C** a fortnight.
  - D** a calendar month.

**1.9** In use, the tower crane would be unstable without the counterbalance because

- 1 there is no large stable base to the crane.
- 2 there are no cables to the ground holding the tower upright.
- 3 the load and main jib will create a turning movement about the base of the crane.
- 4 the material the tower is made from is extremely rigid.

Answer

- A if 1 and 2 only are true.
- B if 1 and 3 only are true.
- C if 1 and 4 only are true.
- D if 2 and 3 only are true.

**1.10** When in use and ignoring the weight of the jib, a weight of 60 000 N at a distance of 6 m from the vertical axis would need a counterbalance at 4 m from the vertical axis of

- A 9 000 N
- B 40 000 N
- C 80 000 N
- D 90 000 N

**1.11** With the information in Question 1.10, if the load moves to 9 m from the central axis, the counterbalance must move away from the central axis by a further distance of

- A 2 m
- B 3 m
- C 4 m
- D 6 m

**1.12** The counterbalance is movable so that

- 1 it can be used to counter cross winds.
- 2 it allows the jib trolley to move along the main jib.
- 3 it helps the crane to spin around without vibrating.
- 4 the load may be greater than the weight of the counterbalance.

Answer

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

**1.13** When the crane driver finishes for the day he/she will ensure that

- A the counterbalance is adjacent to the cab.
- B the counterbalance is at a distance from the cab that compensates for the weight of the jib.
- C the counterbalance is removed from the jib.
- D a temporary load is hoisted to compensate for the counterbalance.

Turn over ►

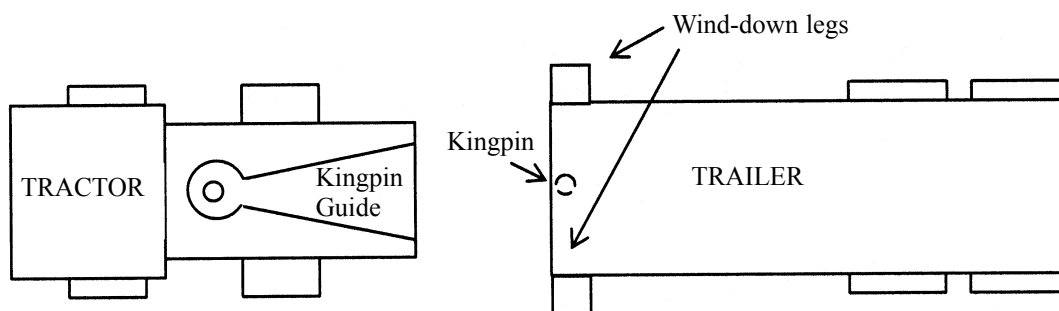
**Questions 1.14 to 1.17***Articulated Lorry*

An image of an articulated lorry was printed in the examination paper at this point, but it is not produced here due to third-party copyright constraints.

**Figure 2: Articulated Lorry**

On an articulated lorry as above, the mechanism for coupling and uncoupling works as follows:

A kingpin attached underneath and at the front of the trailer slides into the kingpin guide until it drops into a central slot to effect coupling. The trailer has legs which wind down to provide support at the front end of the trailer when it is uncoupled. A mechanical brake is used to lock the trailer wheels.

**Figure 3: Coupling/Uncoupling**



- 1.14** When uncoupling the trailer, which of the following sequences is in the correct order for maximum safety?
- A** Disconnect kingpin lock, drive forward slowly, wind down trailer legs.
  - B** Put trailer mechanical brake 'ON', wind down trailer legs, turn off air line brake, disconnect kingpin lock, drive forward slowly.
  - C** Turn off air line brake, disconnect kingpin lock, wind down trailer legs, put trailer mechanical brake 'ON', drive forward slowly.
  - D** Wind down trailer legs, drive forward slowly, disconnect kingpin lock.
- 1.15** When coupling the trailer, which of the following sequences is in the correct order for maximum safety?
- A** Close kingpin lock, wind up trailer legs, move off, release trailer brake.
  - B** Wind up trailer legs, reverse tractor under trailer, move off.
  - C** Close kingpin lock, wind up trailer legs, release trailer brake, move off.
  - D** Wind up trailer legs, close kingpin lock, move off.
- 1.16** When uncoupling, the trailer has to be on firm level ground because this
- 1** reduces the risk of movement.
  - 2** prevents strain on brakes.
  - 3** prevents strain on the suspension.
  - 4** prevents strain on the tractor gears.

Answer

- A** if **1**, **2** and **3** are correct.
- B** if **2**, **3** and **4** are correct.
- C** if **1**, **3** and **4** are correct.
- D** if all of them are correct.

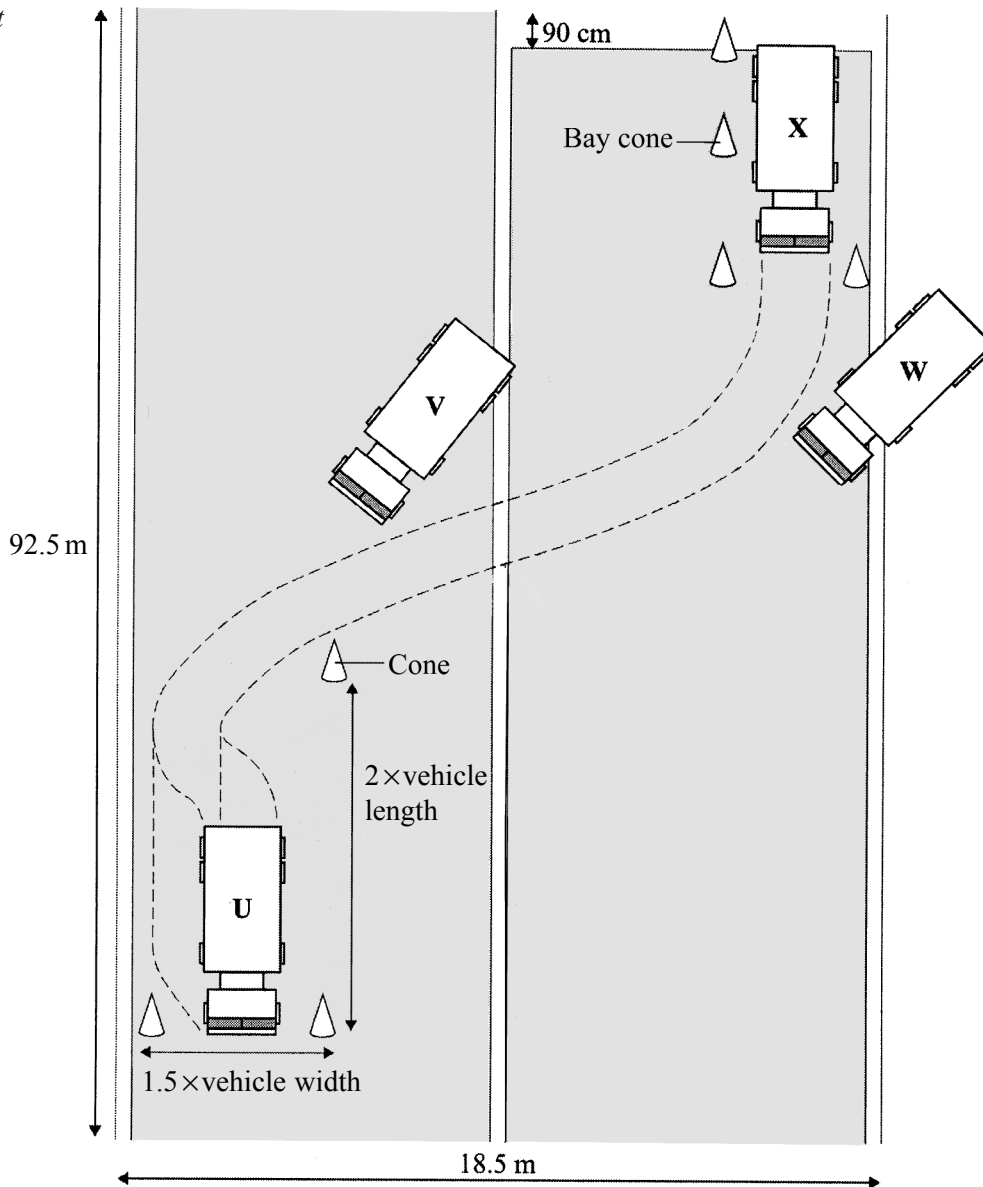
- 1.17** Which of the following may happen when approaching a roundabout and braking too suddenly?
- 1** There may be a transfer of weight to the front of the vehicle.
  - 2** The load may shift forwards.
  - 3** A change of direction may lead to a rollover.
  - 4** The vehicle may jack-knife.

Answer

- A** if **1**, **2** and **3** only may happen.
- B** if **2**, **3** and **4** only may happen.
- C** if **1**, **3** and **4** only may happen.
- D** if all may happen.

Questions 1.18 to 1.20

Reversing Test



**Figure 4: Reversing Test**

U– starting position, X– desired finishing position  
V and W show the outcomes of driving mistakes

**Table 1: Sequence of reversing test operations**

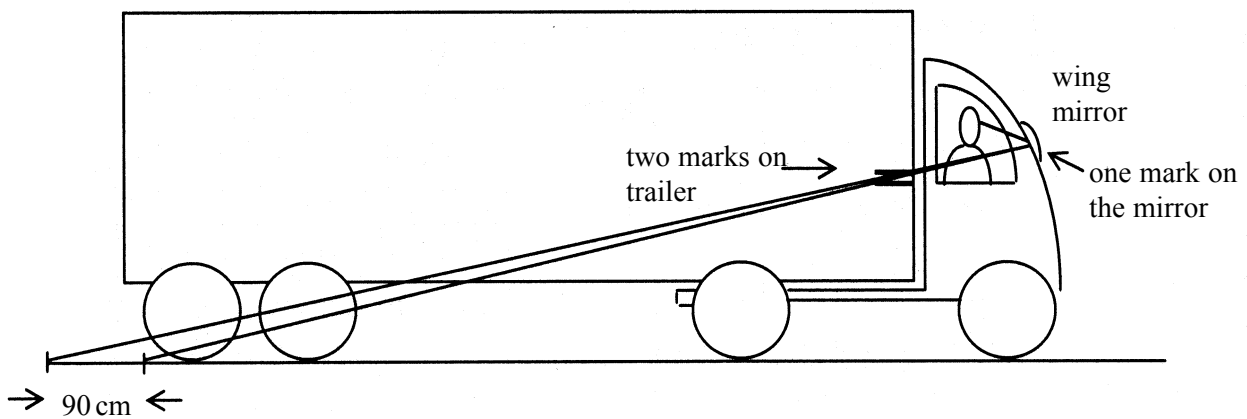
- (1) right hand mirror
- (2)  $\frac{1}{2}$  right hand turn on steering wheel (to get all driver side vehicle wheels on boundary line to utilize available width)
- (3) straight back
- (4) left hand mirror
- (5)  $\frac{1}{2}$  left hand turn on steering wheel when rear wheels level with cone
- (6) straight back
- (7)  $\frac{1}{2}$  right hand turn on steering wheel when rear wheels level with bay
- (8) straight back
- (9) stop when rear is over bay end

**1.18** From the information in Table 1, a driver in the reversing test (Figure 4) has finished at position V when making the following mistake.

- A Fine until (4) then late to start (5).
- B Fine until (4) then early to start (5).
- C  $\frac{1}{2}$  right hand turn at (5) instead of  $\frac{1}{2}$  left hand turn.
- D Fine until (4) then straight to (6).

**1.19** A driver has finished at position W when making the following mistake.

- A Has started (7) too early.
- B Has been too late to start (7).
- C  $\frac{1}{2}$  left hand turn at (7) instead of  $\frac{1}{2}$  right hand turn.
- D Tried to correct from position V with  $\frac{1}{2}$  right hand turn on the steering wheel.



**Figure 5 Sighting for final position**

**1.20** Figure 5 shows a method a driver may use to get a line of sight of the rear end of his lorry in order to finish the test successfully. For a longer trailer, the advice to the driver would be to

- A put the marks in the same positions.
- B adjust the mark on the mirror upwards with marks on the trailer at the same height as previously.
- C adjust the marks on the trailer higher than previously.
- D adjust the marks on the trailer lower than previously.

**END OF QUESTION 1**

**TURN OVER FOR QUESTION 2**

**Turn over ►**

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**QUESTION 2**

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

Each question carries 25 marks.

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This question must be answered in a **separate** answer book which must be clearly labelled **GSA5 Question 2**. Include relevant science wherever appropriate. Write as if you are addressing the intelligent general reader.

The assessment of your answer will take account not only of content but also your use of English, including spelling, punctuation, vocabulary, sentence construction and the organisation of your essay.

**2.1** Proposals for the new British national ID card include biometric data on fingerprints or iris patterns.

Describe the technological aspects of the way this data will be collected and stored. Discuss any ethical and practical concerns which might be raised.

**2.2** Compare and contrast the scientific features of a digital camera with a traditional camera using film, indicating those applications or uses where one may be preferred to the other.

**2.3** There are over 100 000 tonnes of nuclear waste stored in the United Kingdom.

Explain how this waste was produced and evaluate the options for its disposal.

**2.4** A low carbohydrate, high protein diet is considered by many health professionals as unbalanced.

What is a balanced diet and why is it regarded as important for our health and lifestyles?

**2.5** Discuss the arguments for and against using animals in scientific research to improve the quality of human life.

**2.6** Outline the different ways in which alcoholic drinks are produced and discuss the claim that drinking alcohol is a harmless pleasure.

**END OF QUESTIONS**

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