

General Certificate of Education
June 2004
Advanced Level Examination



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

GSA5

Thursday 17 June 2004 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 1.25 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 Question 1 (1.1 to 1.25) 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.
- Make sure that you hand in **both** your answer sheet **and** your essay answer book at the end of the examination.

Information

- This paper consists of **two** questions.
Question 1 contains 25 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 each of Questions 2.1 to 2.6.

Advice

- Spend approximately equal amounts of time on Questions 1 and 2 as a whole.
- 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.

QUESTION 1

Answer Questions 1.1 to 1.25

For each of Questions 1.1 to 1.25 choose the answer you consider the best of the alternatives offered in A, B, C and D.

Questions 1.1 to 1.8

Tides

Figure 1 and Table 1 were obtained from the website of the UK Hydrographic Office.

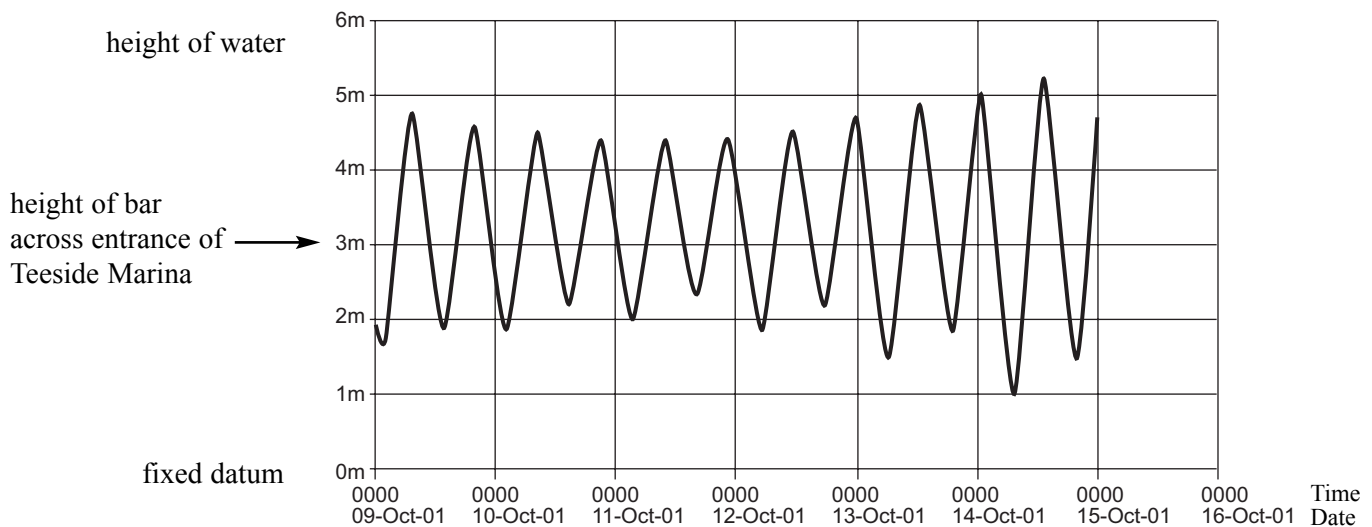


Figure 1: River Tees Entrance

Every twelve hours or so, the sea falls in a low tide then rises again in a high tide. Tides are caused by the way the moon's gravity pulls the water in the ocean into an egg shape around the Earth, creating a bulge on each side of the Earth.

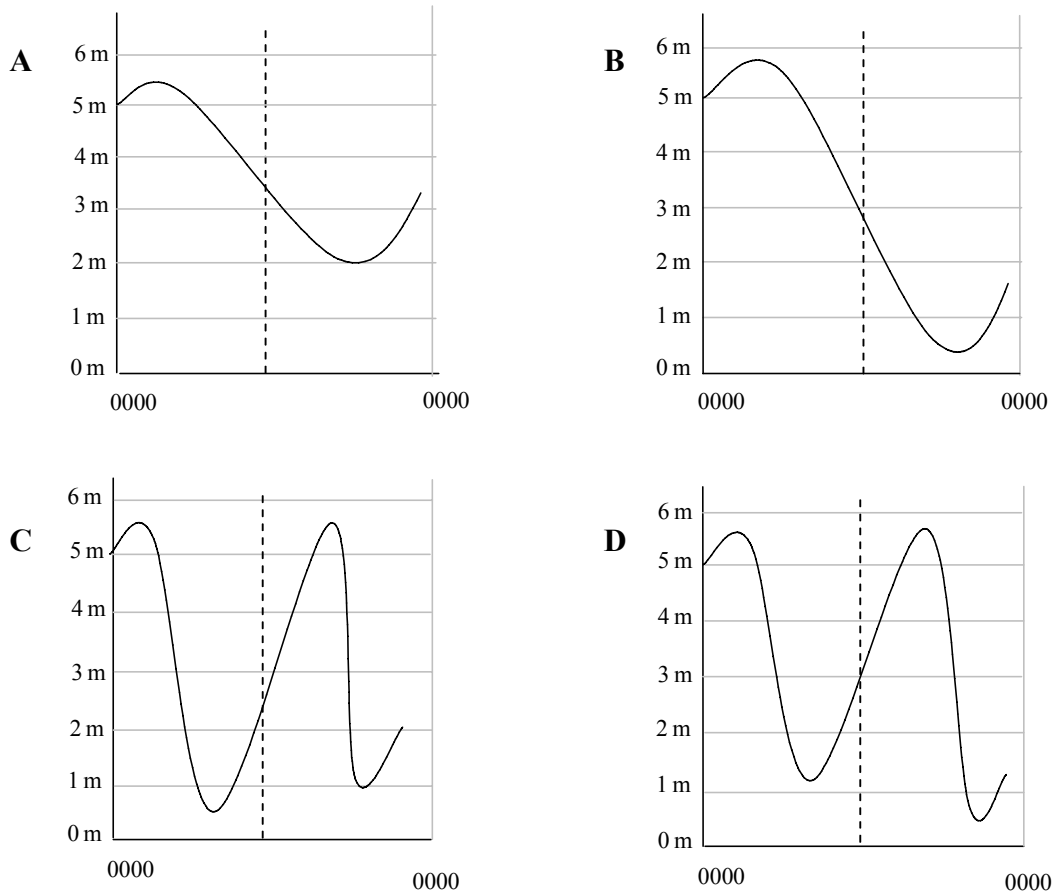
High / Low Waters (The figures are for the tides at the mouth of the Tees.)

09 Oct 2001			10 Oct 2001			11 Oct 2001			12 Oct 2001		
	time	height		time	height		time	height		time	height
high	07:33 20:03	4.7 m 4.6 m	high	08:40 21:13	4.5 m 4.4 m	high	10:05 22:35	4.4 m 4.4 m	high	11:05 23:46	4.5 m 4.6 m
low	01:21 13:44	1.7 m 1.9 m	low	02:18 14:50	1.9 m 2.2 m	low	03:41 16:27	2.0 m 2.3 m	low	05:30 17:50	1.7 m 2.1 m

13 Oct 2001			14 Oct 2001			15 Oct 2001		
	time	height		time	height		time	height
high	12:45	4.8 m	high	01:02 13:42	5.0 m 5.2 m	high	01:55 14:30	5.4 m 5.5 m
low	06:38 19:04	1.5 m 1.8 m	low	07:39 20:00	1.0 m 1.4 m	low	08:30 20:48	0.6 m 1.1 m

Table 1: River Tees entrance. From midnight local time

1.1 Using the data in Table 1, 15 October in Figure 1 would look like



1.2 During the week, the following trends were observed:

- 1 the heights of successive high tides were gradually decreasing and then increasing.
- 2 the heights of successive low tides were gradually increasing and then decreasing.
- 3 the heights of the first low tide of the day were gradually increasing then decreasing.
- 4 the heights of the second low tide of the day were gradually increasing then decreasing.

Answer

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

1.3 The morning high tide at the River Tees Entrance on 16 October would be at approximately

- A 1.00 am.
 B 3.00 am.
 C 9.00 am.
 D 11.00 am.

Turn over ►

1.4 There is only one high tide on 13 October because

- A the cyclical time between successive high tides is greater than 12 hours.
- B the moon is new.
- C this is a characteristic feature on 13th day of every month.
- D an off shore wind is forecast.

1.5 An underwater barrier, a bar, at a height of 3 metres (Figure 1) is built across the entrance to the Teesside Yachting Marina to stop each of the following **except**

- A dangerous currents entering the marina.
- B yachts with large keels entering the marina.
- C trawling for fish on entering or leaving the marina.
- D yachts becoming grounded when the tide goes out.

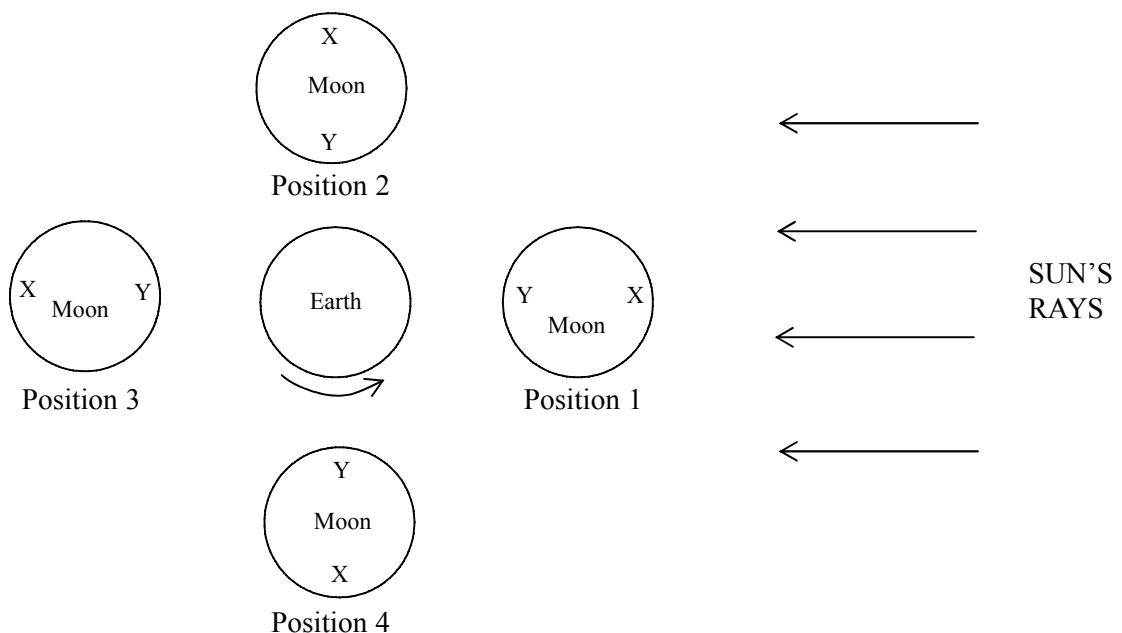
1.6 The tidal flow of water slows down the Earth's rotation.

The day length is increasing $\frac{1}{1000}$ seconds every century.

If slowing down continues at this rate, days will be twice as long in $60 \times 60 \times 24 \times 100 \times 1000$

- A seconds.
- B hours.
- C days.
- D years.

1.7



The diagram shows how we always see only one side of the moon from Earth because the moon goes around its orbit once every $27\frac{1}{3}$ Earth days. A moon day (the time from one sunrise to the next) lasts

- A one Earth day.
- B $27\frac{1}{3}$ Earth days.
- C one Earth year.
- D forever.

1.8 Tidal charts are vital for mariners for which of the following reasons?

- 1** assessing risk of grounding when anchored
- 2** weather prediction
- 3** avoiding reefs
- 4** clearing the bar when entering a marina

Answer

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

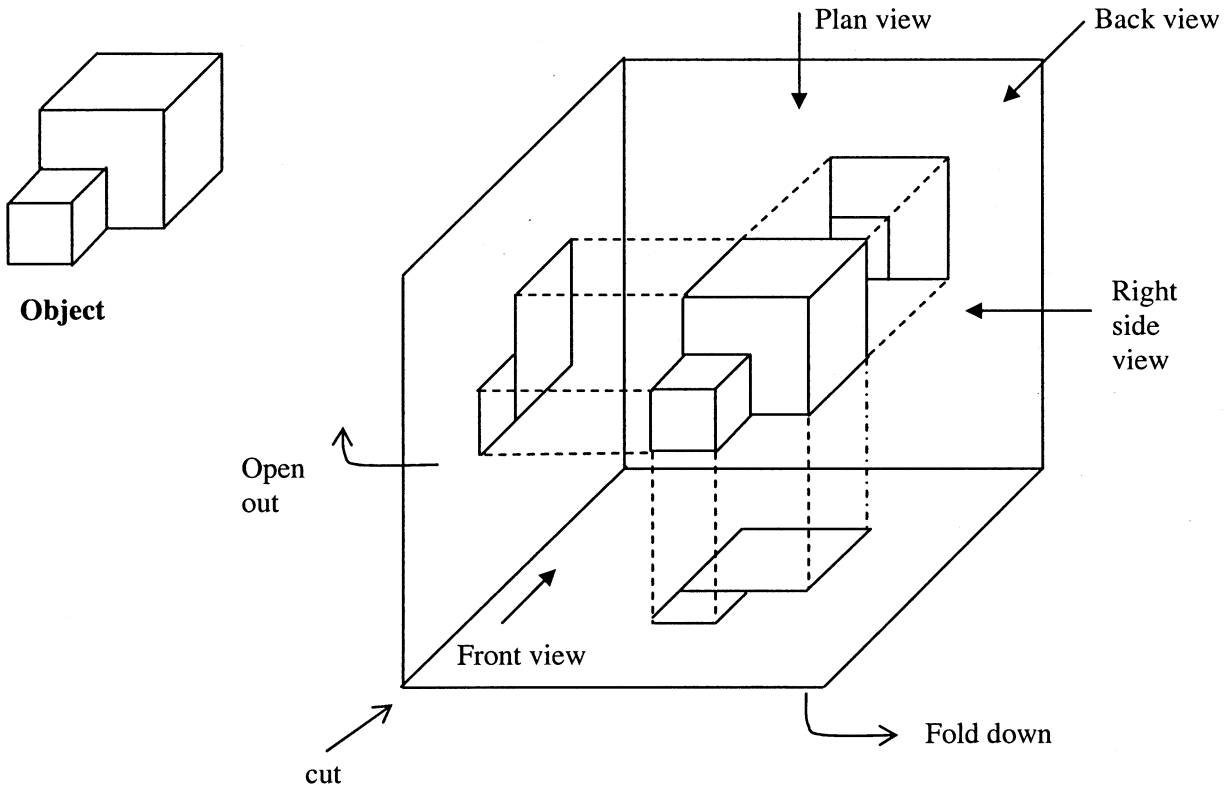
TURN OVER FOR THE NEXT QUESTION

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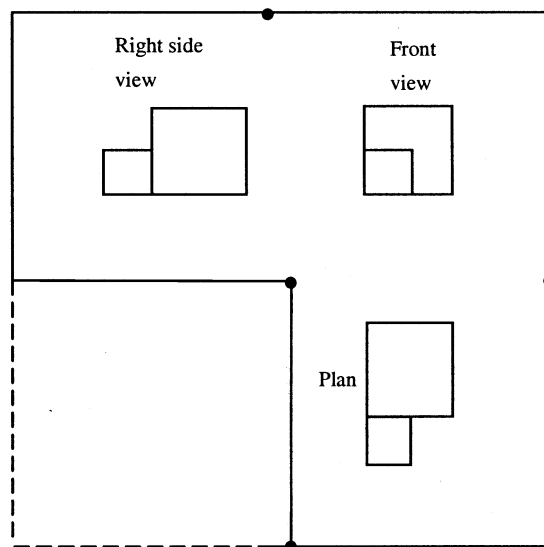
Questions 1.9 to 1.17

Engineering drawing - Projections

Three dimensional objects may be represented by a number of two-dimensional views. In the method called 'first angle projection', what is seen when looking at each face of an object is projected onto the imagined wall of a box opposite to the viewpoint. When the box is imagined laid out flat, the view from the right hand side appears on the left of the front view, and the plan view appears below the front view.



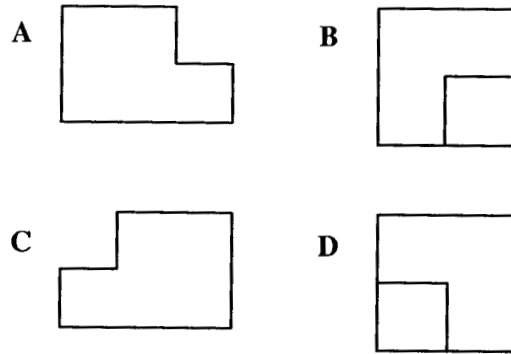
Question 1.9 relates to this block



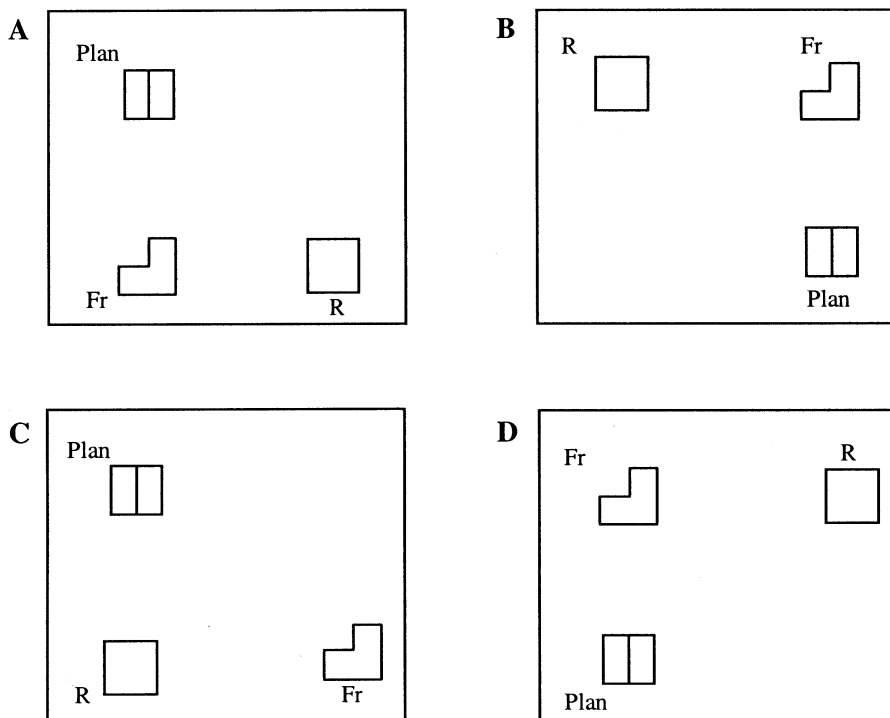
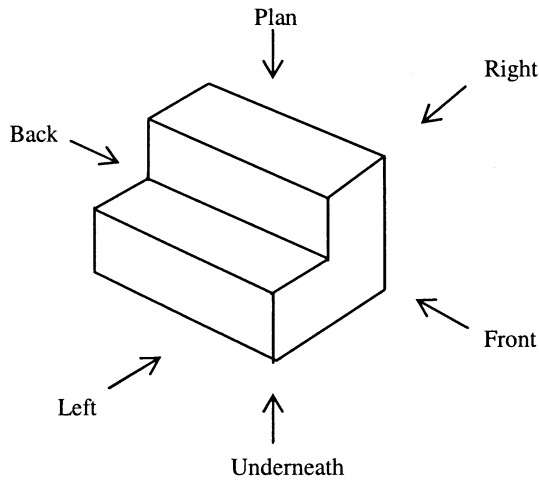
First angle projection

Hidden lines will not be shown in projected views for Questions 1.9 to 1.17.

1.9 The first angle projection of the view from the left hand side is

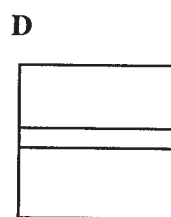
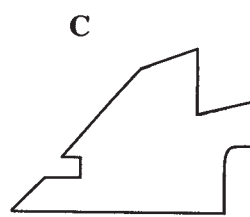
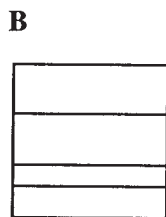
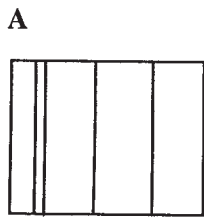
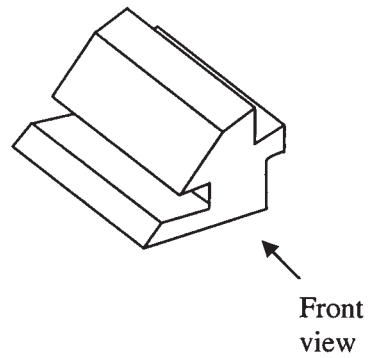


1.10 Which of the following correctly shows the first angle projection of the prism below when seen from the right hand side, above (the plan view) and from the front?



Turn over ►

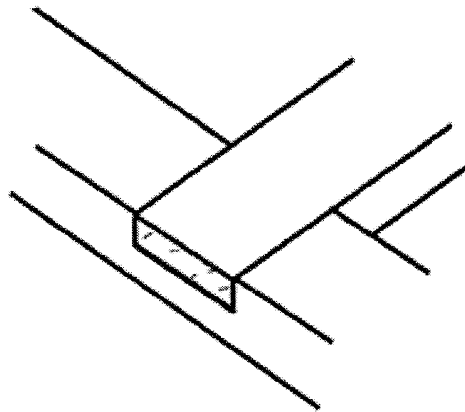
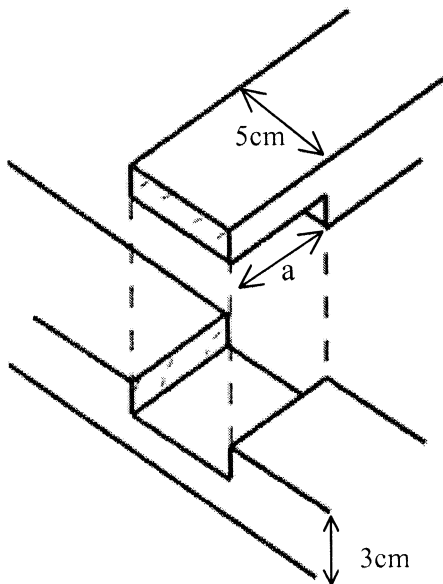
1.11 Which of A to D below is the plan view of this block?



Questions 1.12 and 1.13

Joints

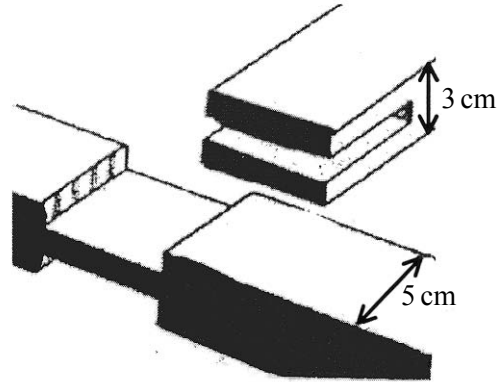
T-halving joint. A quick and simple method of jointing wood of equal thickness. Glue and pin the pieces together for greatest strength.



1.12 If both pieces of wood above are 5.0 cm × 3.0 cm section, then 'a' should be cut to be at least

- A 2.0 cm
- B 3.0 cm
- C 4.0 cm
- D 5.0 cm

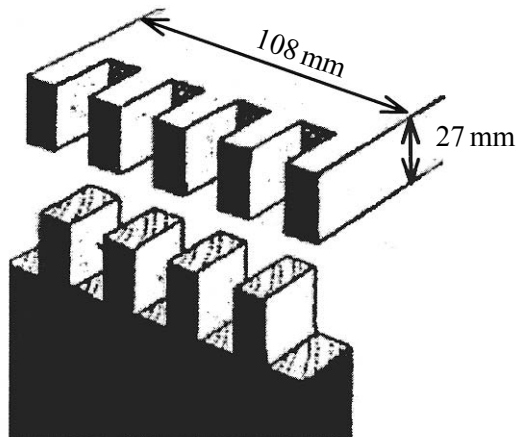
1.13



Using the same wood an alternative joint is shown above. The thickness of the central piece of wood for a strong joint is likely to be

- A 0.5 cm
- B 1.0 cm
- C 1.5 cm
- D 2.0 cm

Questions 1.14 and 1.15



1.14 The width of each projection or groove in mm for a strong joint will be

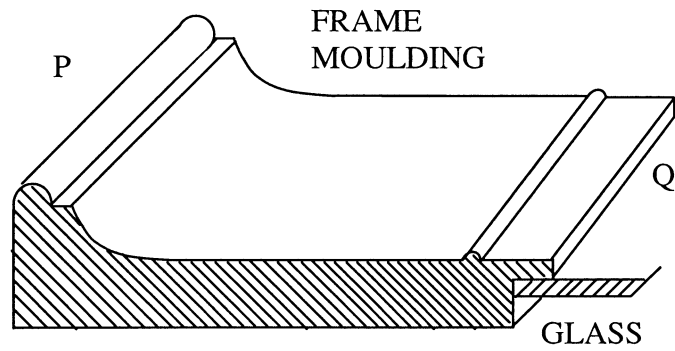
- A 3
- B 9
- C 12
- D 22

1.15 The depth of the grooves in mm should be

- A 3
- B 9
- C 27
- D 54

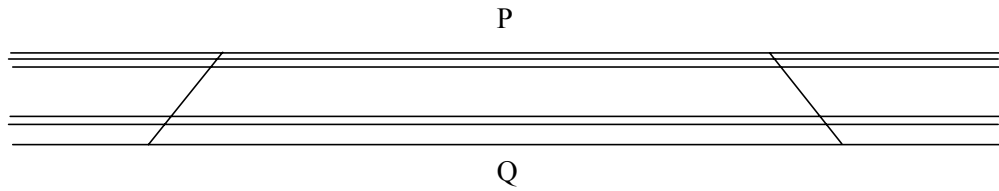
Turn over ►

1.16 To make a picture frame the moulding must be cut at 45° at each end to make the corners.

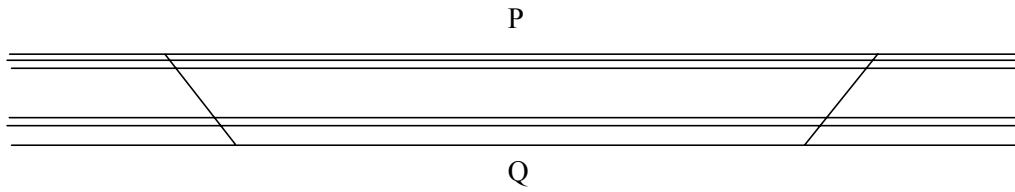


Which diagram shows the moulding cuts correctly marked for one side of the frame?

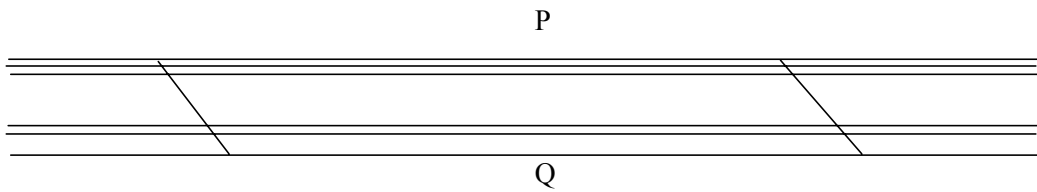
A



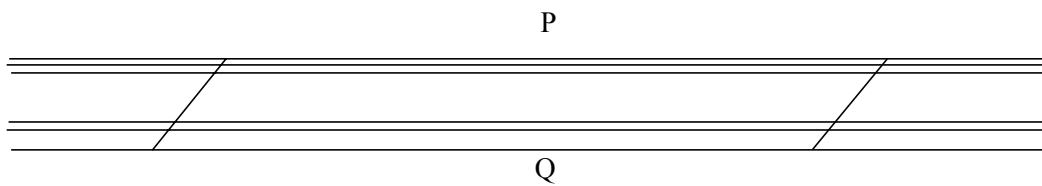
B



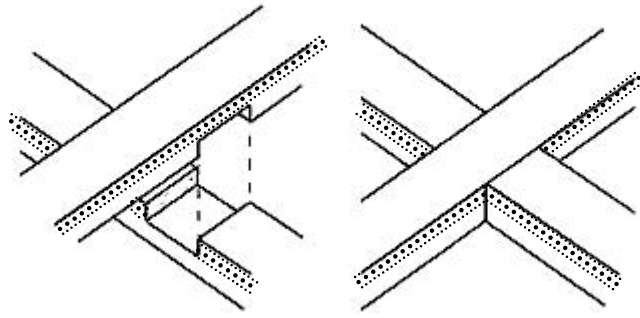
C



D

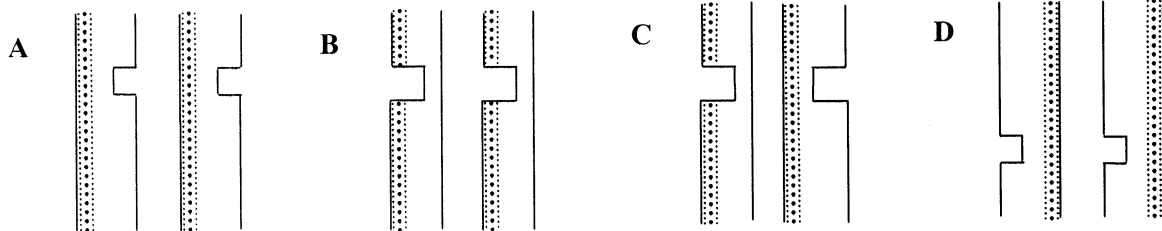


1.17



A cross halved joint is required from wood with a decorative finish along one edge.

The two pieces which are cut correctly are



TURN OVER FOR THE NEXT QUESTION

Questions 1.18 to 1.23

Pulley Drives

Pulleys and drive belts are used in power transmission when there is a separation of the driver shaft and the driven shaft. One driver may power several machines. Gear wheels can only be used in contact with each other.

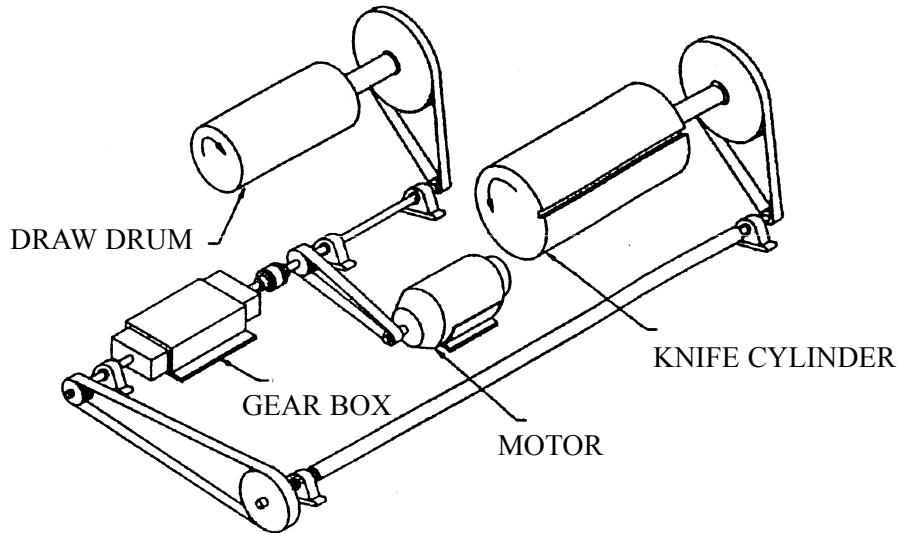


Figure 2: A practical example of the use of pulley drives – a mechanism with the purpose of precisely cutting paper sheets

A pulley relies on friction between its surface and the belt, but a pulley may have teeth (sprockets) which engage in the gaps in a chain, as on a bicycle. Sometimes a moulded rubber belt has ridges which fit those of a pulley, to decrease slip.

The diameter of a pulley is crucial to the rotation rate and the power developed.

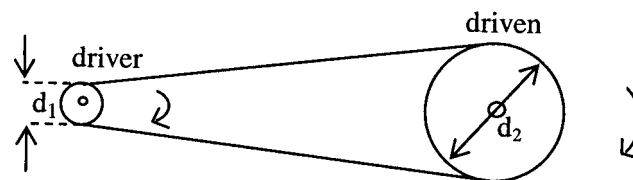


Figure 3a

If the circumference of the driver pulley is 5 times smaller than the circumference of the driven, then for every 5 rotations of the driver the driven will rotate once.

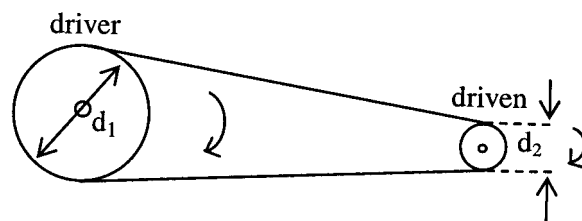


Figure 3b

If the circumference of the driver is 5 times greater than the driven, then the driven will rotate 5 times faster than the driver.

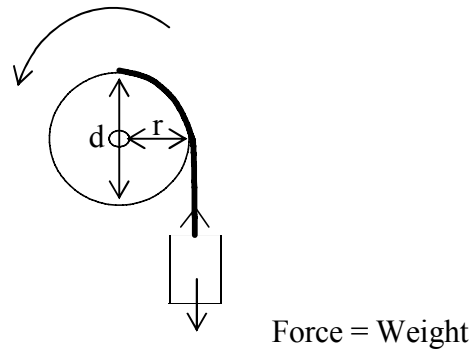


Figure 4

A weight is raised by a drive shaft rotating at a fixed rate, n . In 1 second the weight will rise $2\pi r \times n$. This is the speed of the rope or belt as it is the distance moved in one second. The power developed can be found by force \times speed (as long as they are in the same direction).

If the diameter of the pulley is increased then the speed of the belt is increased and (if n is constant) power will be increased in proportion. In Figure 3a more power is available from the driven shaft. In Figure 3b the driven shaft cannot deliver much power but rotates faster than the driver shaft.

1.18 Two pulleys are linked by a belt as in Figure 3a. The rates of rotation of the two shafts are inversely proportional to the respective pulley diameters. This means

- 1 the bigger pulley goes round faster than the smaller one.
- 2 the bigger pulley goes round more slowly than the smaller one.
- 3 if the pulley diameter ratio is 3:1 the rates of rotation will be 3:1.
- 4 if the pulley diameter ratio is 3:1 the rates of rotation will be 1:3.

Answer

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

1.19 A pulley of diameter 0.40 m is rotated at 2 revolutions per second. The speed of the belt going around the pulley in ms^{-1} is

- A 0.63
- B 1.26
- C 2.50
- D 5.00

1.20 If the diameter of the pulley in Question 1.19 is doubled to 0.80 m and the rate of rotation is unchanged, the power will be

- A halved.
- B the same.
- C doubled.
- D quadrupled.

Turn over ►

1.21 With the change in diameter given in Question 1.20 a load would then move

- A twice as fast.
- B at the same rate.
- C half as fast.
- D one quarter as fast.

1.22 A pulley is lifting a 5 kg mass (weight of 50 N) at 4 ms^{-1} . The power it develops in watts is

- A 4
- B 20
- C 160
- D 200

1.23 n is the number of revolutions per second, d is the diameter (m) and r the radius (m) of the pulley. The speed of the belt, v (ms^{-1}) is given by

- 1 $v = n\pi d$
- 2 $v = n\pi r$
- 3 $v = 2n\pi r$
- 4 $v = \frac{\pi n}{d}$

Answer

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

Questions 1.24 and 1.25

The Source Material for Questions 1.24 – 1.25 is not produced here due to third-party copyright constraints. The full copy of this paper can be obtained by ordering GSA5 from our publications section. Tel: 0161 953 1170.

- 1.24** A bicycle front sprocket (the chainwheel) has 32 teeth and the chain has 64 links. After 4 complete revolutions of the pedals the chain will have moved round
- A 16 times.
 - B 8 times.
 - C 4 times.
 - D twice.
- 1.25** On the bicycle in Question 1.24, the rear sprocket has 16 teeth. When the pedals complete one revolution the back wheel will go round
- A half a revolution.
 - B one revolution.
 - C two revolutions.
 - D four revolutions.

END OF QUESTION 1

TURN OVER FOR QUESTION 2

Turn over ►

QUESTION 2Answer **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 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 What is genetically modified food?

Considering the health and environmental effects, discuss the safety of genetically modified food.

2.2 Where do “near earth objects” come from and what can be done to protect our world from them?**2.3** The 2003 SARS epidemic illustrated our vulnerability to a new viral disease.

Discuss the measures that can be taken to protect populations from infectious diseases.

2.4 “Scientific evidence suggests that climates are changing.”

Discuss the validity and implications of this statement.

2.5 Explain how similes might have achieved their everyday meaning and give a precise scientific meaning for each of the italicised words in **four** of the following.

as *hard* as nails; as *flat* as a pancake; as *drunk* as a lord; as *dense* as a brick; as *certain* as tomorrow;
as *vibrant* as a spring; as *brittle* as glass; as *black* as night.

2.6 Explain the scientific principles underlying mobile phones.

How far do the advantages of mobile phones outweigh their disadvantages?

END OF QUESTIONS**ACKNOWLEDGEMENTS OF COPYRIGHT-HOLDERS AND PUBLISHERS**

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