

FOR OFFICIAL USE

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**3220/401**

K & U PS

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Total Marks

NATIONAL  
QUALIFICATIONS  
2000

WEDNESDAY, 31 MAY  
9.00 AM - 10.30 AM

PHYSICS  
STANDARD GRADE  
General Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

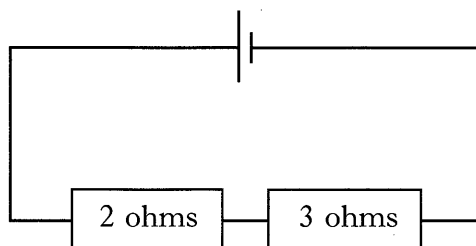
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Number of seat

- All questions should be answered.
- The questions may be answered in any order but all answers must be written clearly and legibly in this book.
- For questions 1–4, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.
- For questions 5–18, write your answer where indicated by the question or in the space provided after the question.
- If you change your mind about your answer you may score it out and replace it in the space provided at the end of the answer book.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

Marks

1. In the circuit shown, the current in the 2 ohm resistor is 1 ampere.



What is the current taken from the battery?

- A 0.4 ampere  
B 1 ampere  
C 2 amperes  
D 3 amperes  
E 5 amperes






Answer

1

2. A student is looking at a sheet of paper which has the letter F drawn on it as shown below.

F

Which is the correct image of the letter formed on the student's retina?

- A   
B   
C   
D   
E 

Answer

1

3. Which of the following electronic devices contains a counter circuit?

- A Amplifier  
B Intercom  
C Burglar alarm  
D Computer  
E Radio receiver

Answer

1

Marks

4. The purpose of the amplifier in a personal stereo is to
- A convert an analogue signal to a digital signal
  - B transform an electrical signal to a sound signal
  - C transform a sound signal to an electrical signal
  - D increase the frequency of an electrical signal
  - E increase the amplitude of an electrical signal.

Answer

1

5. The frequency range and some uses of different radio wavebands are shown.

<i>Waveband</i>	<i>Frequency range (megahertz)</i>	<i>Uses</i>
HF	3 to 30	amateur radio, military communication
VHF	30 to 300	FM radio, air traffic control
UHF	300 to 3000	radar, local TV
SHF	3000 to 30 000	satellite TV, microwave communication

- (a) Give a use, **from the table**, for a radio wave which has a frequency of 106 megahertz.

.....

1

- (b) TV is broadcast in the United Kingdom on the UHF waveband.  
What is the **range** of frequencies in this waveband?

.....

1

[Turn over

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6. Two different communication systems are used at a concert. One is for public announcements and the other is used by security staff.

(a) Public announcements are made using a microphone and are heard by the audience from loudspeakers.

What energy transformation takes place in

(i) the microphone

.....

1

(ii) the loudspeakers?

.....

1

(b) Two members of the security staff communicate using two-way radios. Each radio consists of a transmitter and a receiver.



(i) At what speed do signals travel between the two-way radios?

.....

1

(ii) Explain why no cables are needed to carry the signals between one radio and the other.

.....

.....

2

*Marks*

**6. (continued)**

- (c) For each communication system, give **one** reason why it is suitable for its purpose.

Public announcement system .....

.....

Two-way radios .....

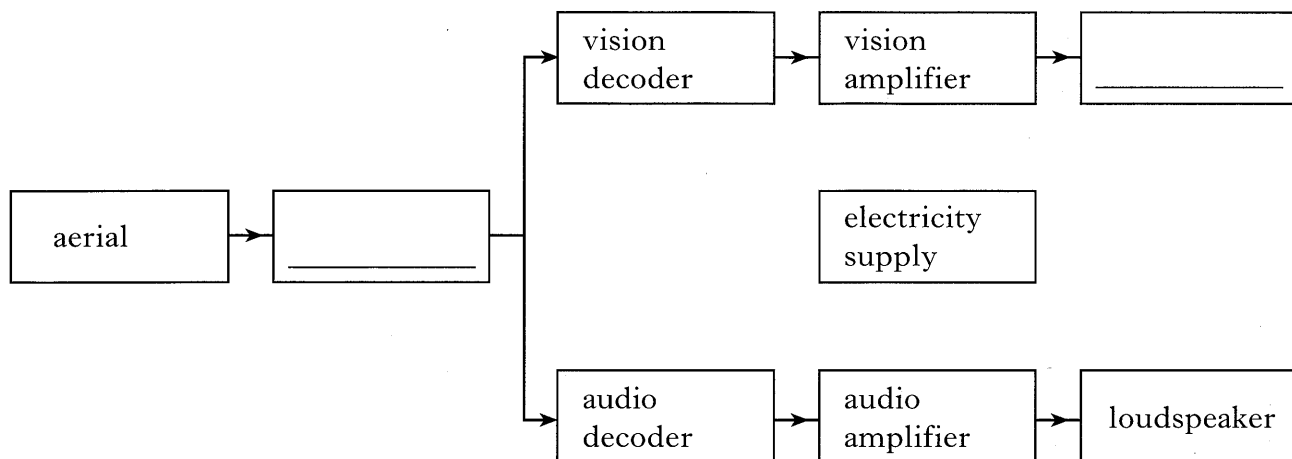
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Marks

7. The block diagram shows the main parts of a television receiver. The labels in two of the blocks are missing.



(a) Complete the block diagram by filling in the two missing labels.

1

(b) Which part of a television receiver picks up the incoming signals?

.....

1

(c) What is the purpose of the electricity supply in a television receiver?

.....

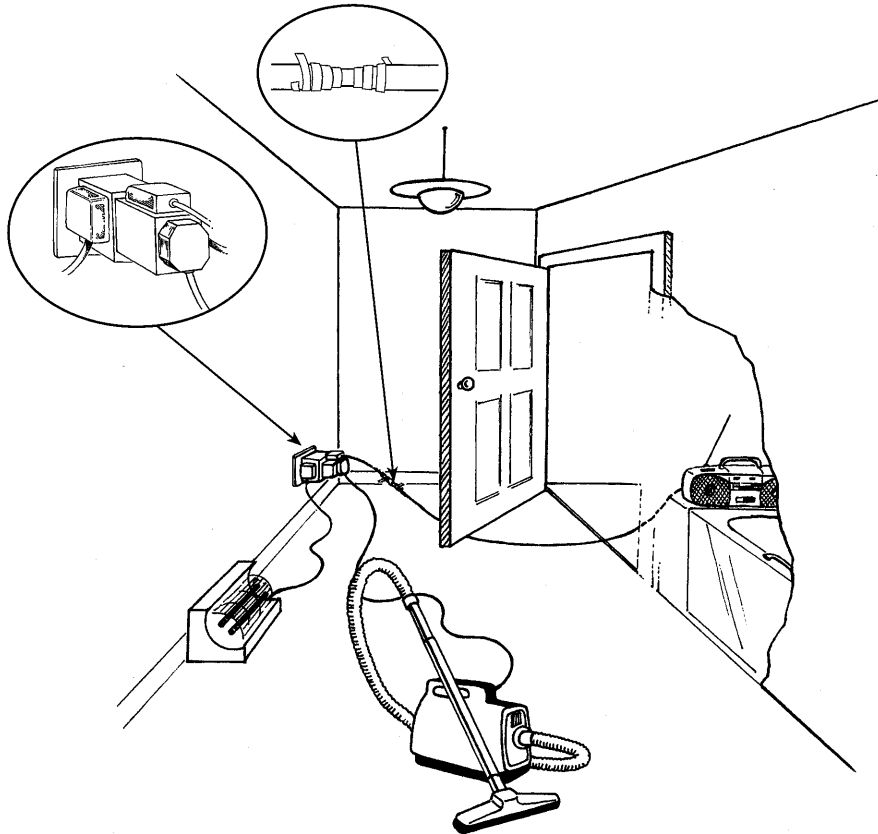
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8. There are several electrical hazards shown in the picture.



Identify **two** of the electrical hazards shown and for each explain why it is dangerous.

Hazard 1 .....

Reason it is dangerous .....

.....

Hazard 2 .....

Reason it is dangerous .....

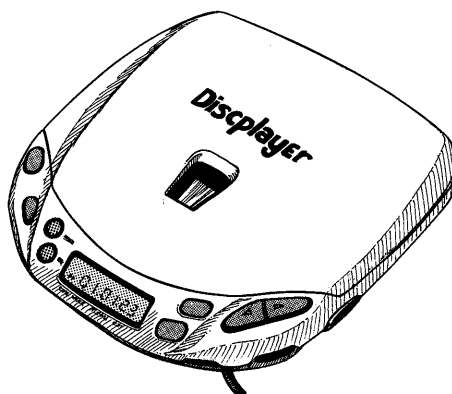
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Marks

9. A CD player has a power rating of 0.3 watt and operates from a 6 volt power supply.



- (a) Calculate the current in the CD player when it is operating.

*Space for working and answer*

2

- (b) Power for the CD player can be supplied using batteries or the mains.

- (i) Draw the circuit symbol for a battery.

*Space for diagram*

1



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9. (b) (continued)

(ii) For mains operation an adaptor reduces the voltage to 6 volts.

(A) What is the declared value of the mains voltage?

.....

1

(B) What device in the adaptor reduces the voltage?

.....

1

(iii) State and explain the difference between current from the mains supply and current from a battery.

Mains supply .....

.....

Battery supply .....

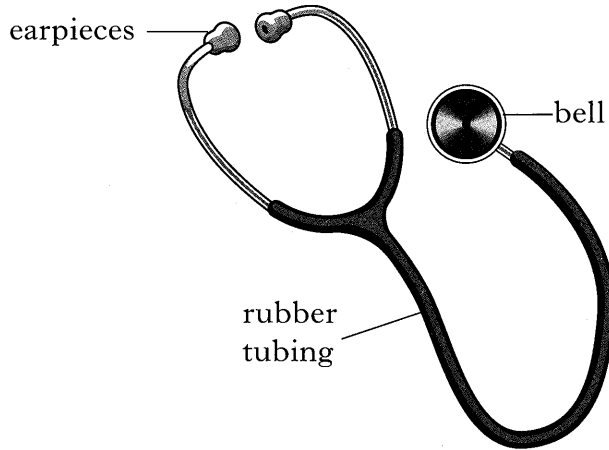
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Marks

10. A doctor uses a stethoscope like the one shown in the diagram to listen to the sounds of a patient's heart.



- (a) Explain how the stethoscope acts as a "hearing aid" for the doctor.  
Your explanation must give the purpose of each of the parts labelled in the diagram.

.....

.....

.....

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.....

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3

- (b) Why is it important that the bell makes firm contact with the patient's body?

.....

.....

1


Marks

11. Different types of radiation are used in the detection and treatment of illnesses and injuries.

Four of these radiations are

**infrared**      **laser light**      **ultraviolet**      **X-rays**

Which of the above radiations is used for each of the following?

(a) In optical surgery to repair small tears in the retina.

..... 1

(b) To treat a skin condition such as acne or eczema.

..... 1

(c) To detect a broken bone in an arm.

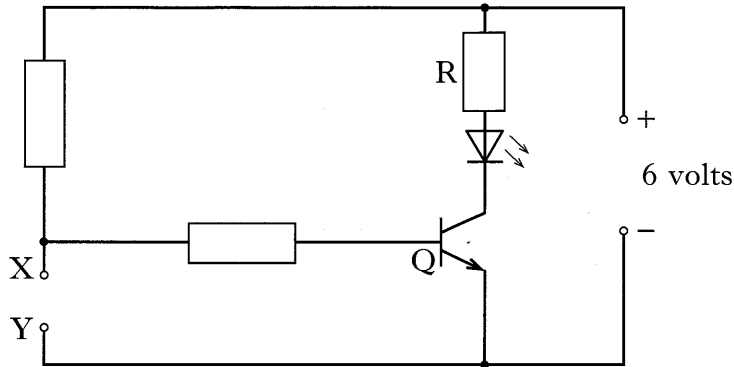
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12. The circuit shown can be used to build models of different electronic devices. This is done by inserting a different component between X and Y for each model.



- (a) Three models of electronic devices are built using this circuit. In each model **one** component from the list below is placed between X and Y.

**buzzer capacitor lamp LDR LED thermistor**

Complete the table to show which component is used for each device.

<i>Device</i>	<i>Component</i>
Automatic night light	
Automatic fire alarm	
Time delay for pedestrian crossing	

3

- (b) (i) Name component Q.

.....

1

- (ii) What is the purpose of component Q in this circuit?

.....

1

- (c) What is the purpose of resistor R in this circuit?

.....

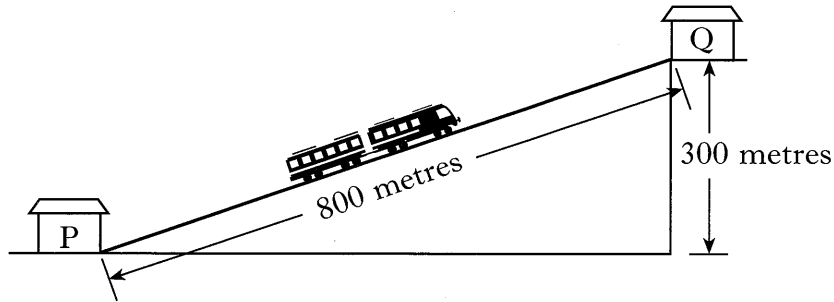
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14. A train carries passengers up the side of a mountain. The mass of the loaded train is 20 000 kilograms.



- (a) Calculate the weight of the loaded train.

<p><i>Space for working and answer</i></p>	2
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- (b) As it moves up the mountain, the forces acting on the train are balanced. Describe the motion of the train.

<p>.....</p>	1
<p>.....</p>	

- (c) The train climbs up the mountain from P to Q in 8 minutes.

- (i) Calculate the potential energy gained by the loaded train as it moves from P to Q.

<p><i>Space for working and answer</i></p>	2
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Marks

14. (c) (continued)

- (ii) Calculate the minimum power output of the motor used to raise the loaded train.

<i>Space for working and answer</i>
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2

- (iii) Why is the actual power output of the motor greater than that calculated in (c)(ii)?

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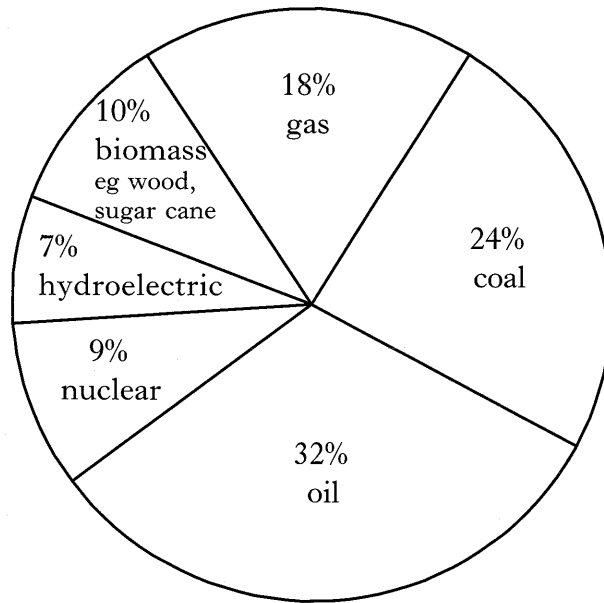
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15. The pie chart shows the estimated use of the world's main energy sources for the year 2000.



- (a) Use the names of the energy sources given in the pie chart to complete the table.

<i>Fossil fuels</i>	<i>Other energy sources</i>

3

- (b) Use the pie chart to calculate the total percentage of energy supplied by fossil fuels.

*Space for working and answer*

1



Marks

15. (continued)

(c) Why is it important to find sources of energy other than fossil fuels?

.....  
.....

1

(d) Name **one** renewable source of energy that is not mentioned in the pie chart.

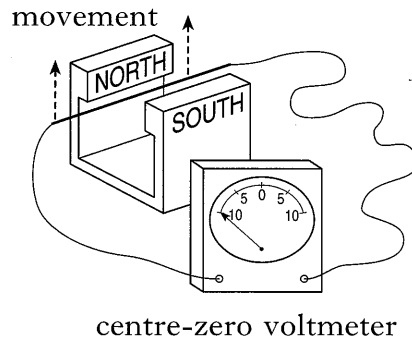
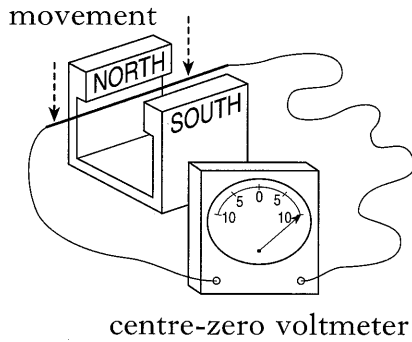
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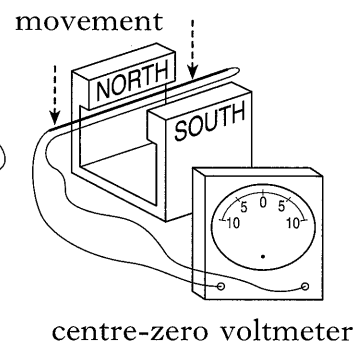
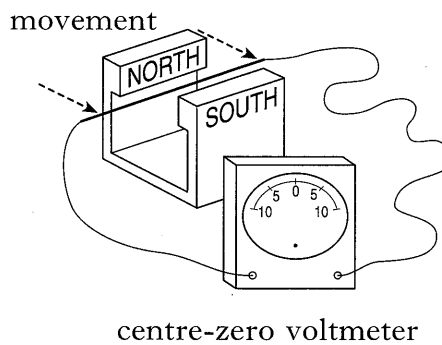
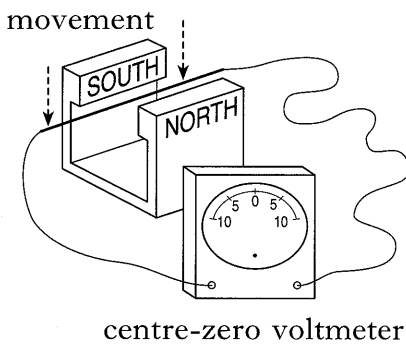
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Marks

16. (a) A conductor is moved between the poles of a magnet.  
The diagrams show the positions of the pointer on a centre-zero voltmeter when the conductor is moved as shown.



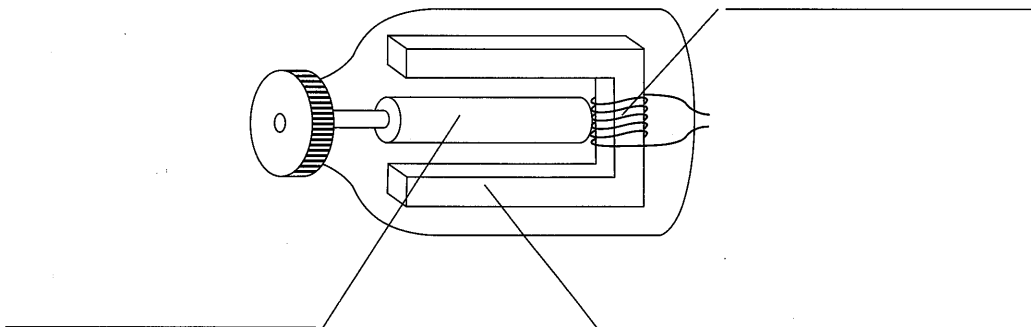
The diagrams below show other situations in which the conductor is moved between the poles of the magnet.



In each case, show on the diagram the position of the pointer **while the conductor is moving**.

3

- (b) The diagram shows how a bicycle dynamo is constructed.



Use the names given below to label the three main parts of the dynamo.

coil      iron core      magnet

2

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17. Read the following passage.

On clear nights it is possible to see light from many of the stars in our galaxy. In addition, some of the planets in our solar system can be seen because they reflect sunlight.

One star in our galaxy which often appears bright in the sky is called Sirius. The light from Sirius which arrives on Earth tonight started out on its journey from the star in the middle of 1991.

(a) How long, to the nearest year, does light take to reach Earth from Sirius?

<i>Space for working and answer</i>	
1	

(b) Which terms **used in the passage** mean

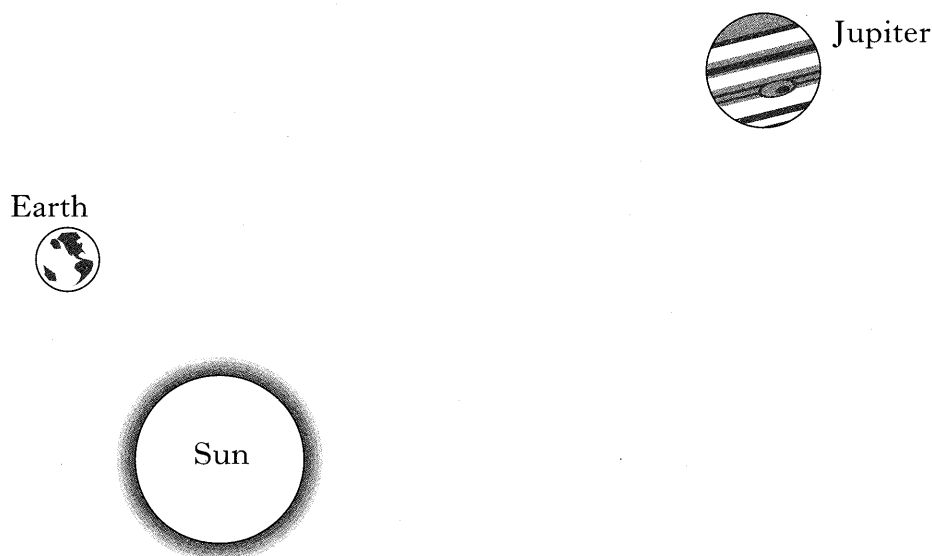
a body that orbits a star .....

a large cluster of stars .....

a glowing ball of gas? .....

3

(c) The diagram below shows the Sun, the Earth and the planet Jupiter. (The diagram is not to scale.)



Show how Jupiter can be seen from Earth by adding rays of light to the diagram, and giving the direction the light travels.

2

17. (continued)

(d) Arrange the following in order of distance from Earth.

**edge of our galaxy      Sirius      Sun**

<i>Nearest to Earth</i>		<i>Furthest from Earth</i>

Marks

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<b>2</b>	
<b>1</b>	
<b>1</b>	

(e) Scientists obtain information about a star by splitting light from it into different colours.

(i) What is the name of the glass shape that is used to split light into different colours?

.....

**1**

(ii) Light from a star produces a line spectrum.  
What information about the star can be obtained from this spectrum?

.....

.....

**1**

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18. In the passage below, circle **one** word or phrase in each set of brackets to make the statements correct.

A large stone and a small stone of the same material are kicked horizontally off a cliff at the same time.

Both stones follow a  $\left\{ \begin{array}{l} \text{curved} \\ \text{straight} \\ \text{vertical} \end{array} \right\}$  path.

Ignoring air resistance, the stones have the same  $\left\{ \begin{array}{l} \text{acceleration} \\ \text{mass} \\ \text{weight} \end{array} \right\}$

because of the  $\left\{ \begin{array}{l} \text{force of friction.} \\ \text{force of gravity.} \\ \text{kick.} \end{array} \right\}$

It is found that  $\left\{ \begin{array}{l} \text{the large} \\ \text{the small} \\ \text{neither} \end{array} \right\}$  stone reaches the ground first.

4

[END OF QUESTION PAPER]

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**YOU MAY USE THE SPACE ON THIS PAGE TO REWRITE ANY ANSWER YOU HAVE DECIDED TO CHANGE IN THE MAIN PART OF THE ANSWER BOOKLET. TAKE CARE TO WRITE IN CAREFULLY THE APPROPRIATE QUESTION NUMBER.**

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