FOR OFFICIAL USE

Presenting Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.
	3220				

G

K & U	PS

Total Marks

3220/101

SCOTTISH CERTIFICATE OF EDUCATION 1998

FRIDAY, 15 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 school or college

Town

First name and initials

Surname

Date of birth
Day Month Year

Candidate number

Number of seat

1 All questions should be answered.

2 The questions may be answered in any order but all answers must be written clearly and legibly in this book.

3 For questions 1–8, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.

4 For questions 9–22, write your answer where indicated by the question or in the space provided after the question.

5 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.

6 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.

SCOTTISH QUALIFICATIONS AUTHORITY

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1. A telephone answering machine contains a loudspeaker which is used in playing back any message received. The main energy transfer in the loudspeaker is

A electrical to sound

B sound to electrical

C chemical to sound

D sound to chemical

E electrical to chemical.

Answer ☐ **(1)**

2. Which of the following is the unit of electrical current?

A joule

B volt

C ampere

D watt

E coulomb

Answer ☐ **(1)**

3. In a solid metal conductor, the current is a flow of

A electrons

B protons

C neutrons

D protons and electrons

E protons and neutrons.

Answer ☐ **(1)**

4. The insulation on the wires in a mains flex is colour coded. Which of the following correctly identifies the live, neutral and earth wires?

	Live	*Neutral*	*Earth*
A	blue	green/yellow	brown
B	green/yellow	brown	blue
C	blue	brown	green/yellow
D	brown	green/yellow	blue
E	brown	blue	green/yellow

Answer ☐ **(1)**

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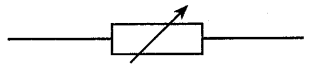
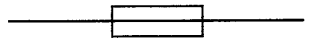
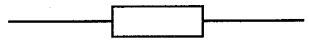
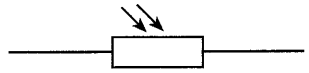
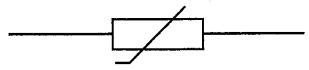
5. Which of the following is the circuit symbol for a fuse?

A 

B 

C 

D 

E 

Answer ☐ **(1)**

6. A ray of light changes direction as it travels from air into water. This effect is called

A diffraction

B diffusion

C incidence

D refraction

E reflection.

Answer ☐ **(1)**

7. Which of the radiations alpha, beta or gamma would be stopped by a sheet of aluminium 5 millimetres thick?

A Alpha only

B Beta only

C Gamma only

D Alpha and beta only

E Beta and gamma only

Answer ☐ **(1)**

8. Which of the following is a non-renewable source of energy?

A Solar

B Wind

C Oil

D Geothermal

E Waves

Answer ☐ **(1)**

[Turn over

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9. A laser uses 1000 joules of energy in a time of 20 seconds.

Calculate the average power of the laser.

Space for working and answer

(2)

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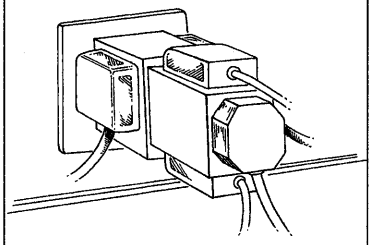
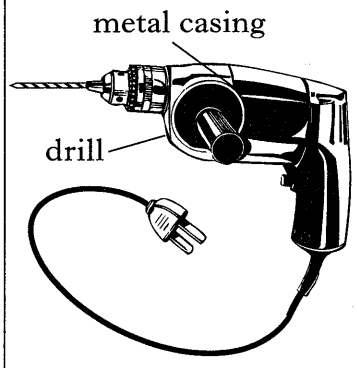
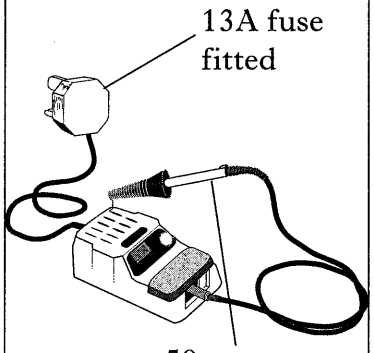
Marks

10. During a safety inspection of a workshop, an inspector notices several dangerous situations which require action before a safety certificate can be awarded.

The diagrams below show some of the situations.

In the spaces provided, state the action required and explain why the situation is dangerous.

The first dangerous situation has been completed for you.

Dangerous situation	*Action required to remove danger*	*Explanation of why the situation was dangerous*
	***Remove one of the adaptors***	***Overheating of the socket and supply cable may occur if the current is too large.***
		
		

(4)

[Turn over

11. A ship is anchored opposite a cliff as shown in figure 1. The ship's siren gives a short blast. A passenger on the ship hears the echo 5 seconds later. *Marks*

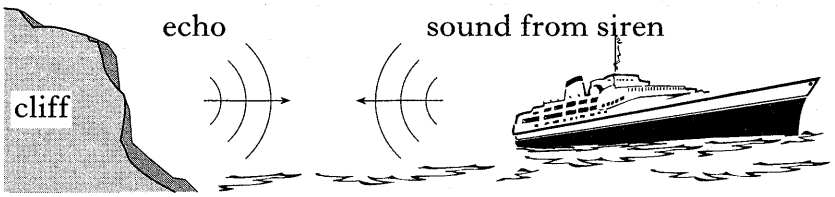


figure 1

(*a*) Calculate how far the ship is from the cliff.
[speed of sound in air = 340 metres per second]

Space for working and answer

(3)

(*b*) Figure 2 shows part of the display panel for the ship's siren. The pointer on the display shows the frequency of the sound produced by the siren.

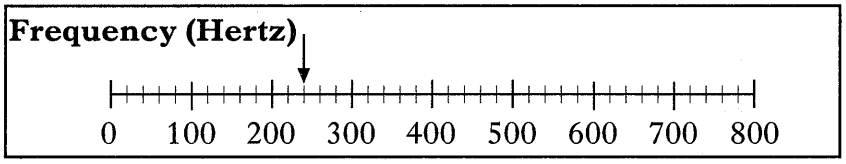


figure 2

(i) What is the frequency of the sound from the siren?

..... **(1)**

(ii) The frequency of the sound is increased to 700 hertz.

Which of the following gives the time taken for the echo of this sound to reach the passenger?

A Greater than 5 seconds

B Less than 5 seconds

C Equal to 5 seconds

Answer ☐ **(1)**

(iii) Explain your answer to part (*b*)(ii).

.....

..... **(1)**

Marks

11. (continued)

(*c*) A microphone and oscilloscope are set up close to the siren as shown.

Figure 3 shows the trace on the oscilloscope when the siren is sounded.

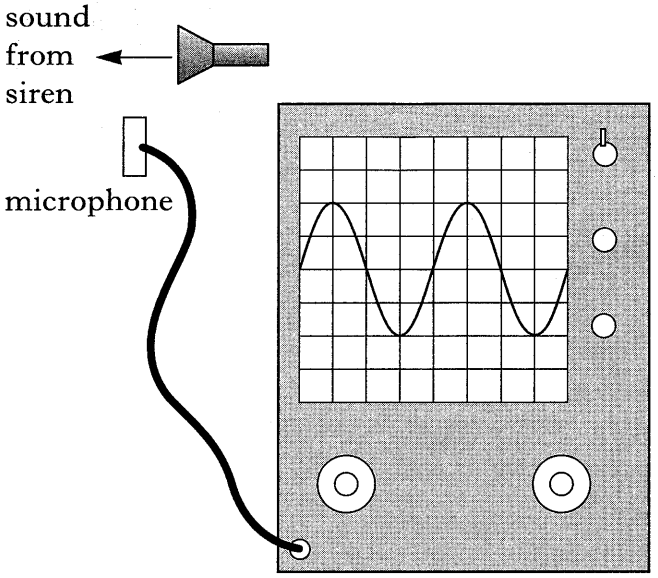


figure 3

On figure 4, sketch the trace which would represent the echo from the cliff.

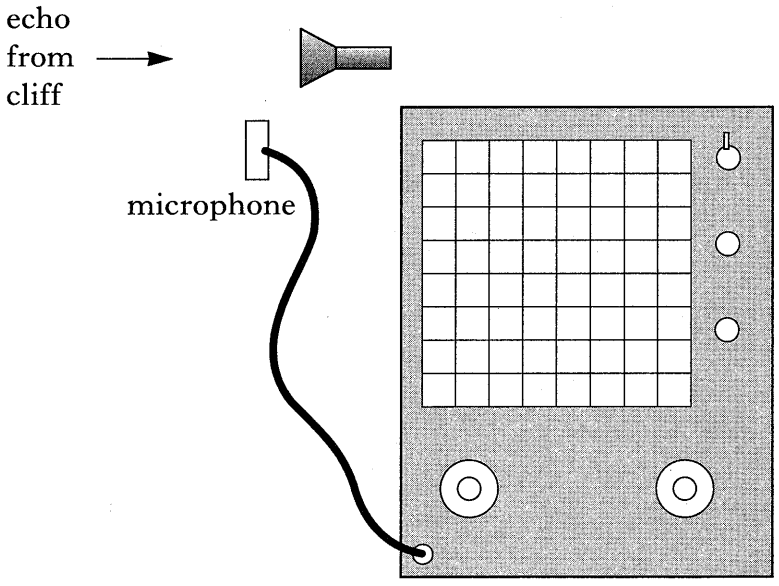


figure 4

(2)

[Turn over

Marks

12. Two friends are spectators at a golf tournament. One attempts to view the play with a home-made telescope and the other uses a periscope as shown in figure 1.

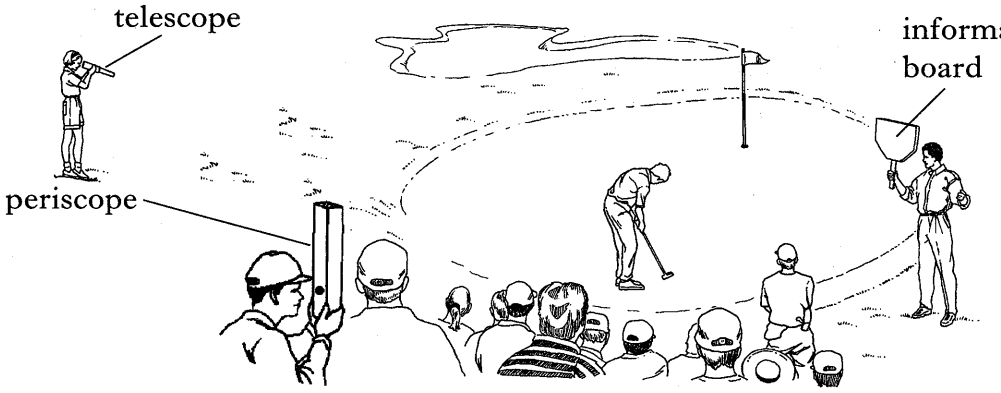
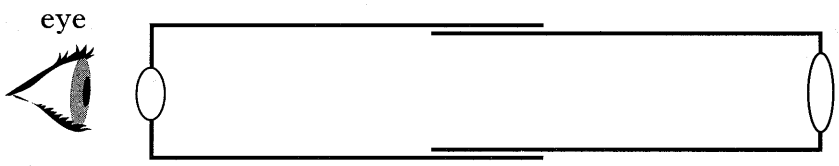


figure 1

(*a*) The telescope is constructed with cardboard tubes and two convex lenses as shown in figure 2.



..... lens ..... lens

figure 2

Name each of the lenses. **(2)**

(*b*) The periscope is made from a cardboard tube and two plane mirrors as shown in figure 3.

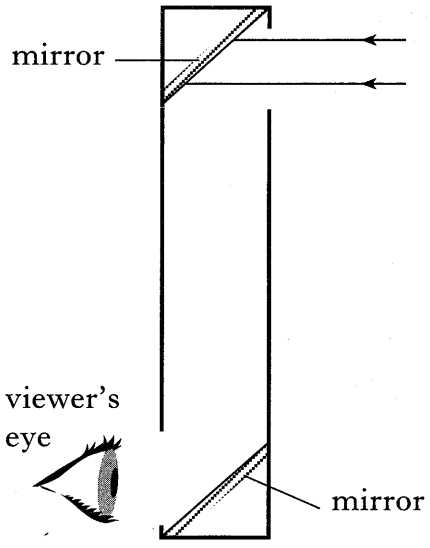


figure 3

Complete the diagram to show how the two rays of light travel through the periscope to the viewer's eye. **(1)**

Marks

12. (continued)

(*c*) The friends use their telescope and periscope to look at the information board held by an official. Figure 4 shows the image of the board as it would be seen by the person looking through the telescope. In the space provided, draw the image of the board as it would be seen by the person looking through the periscope.

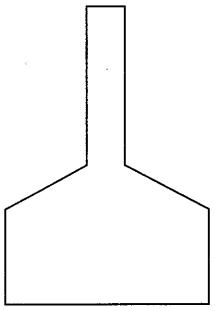


figure 4

Space for drawing

(1)

(*d*) Later, the two friends listen to an interview with the tournament winner on their radio.

Figure 5 shows some of the parts of the radio.

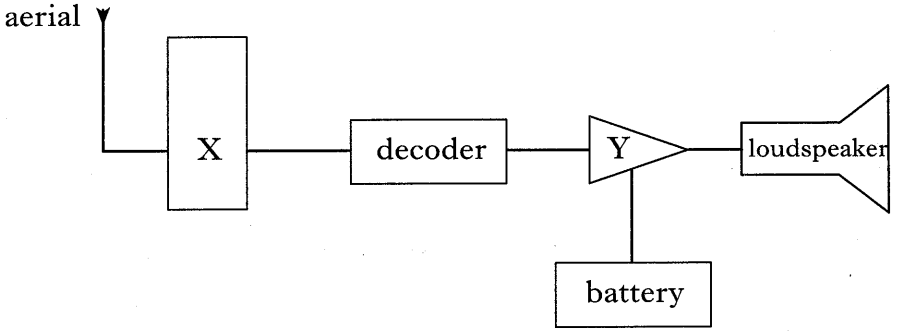


figure 5

Name and describe the function of the parts X and Y in the radio.

Part X .....

.....

.....

Part Y .....

.....

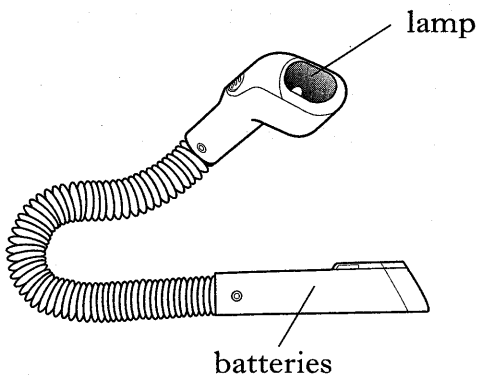
..... **(3)**

[Turn over

Marks

13. Figure 1 shows a flexible inspection lamp.

figure 1



(*a*) When switched on, the lamp does not work. A pupil brings the lamp to the Physics laboratory to investigate the fault.

The pupil connects the bulb of the lamp to a meter to find out if the filament is broken or if there is a short circuit. The meter can be set to measure *current* or *voltage* or *resistance*.

(i) Which quantity should the meter be set to measure?

..... **(1)**

(ii) What will the meter display show:

A if the filament of the bulb is broken; .....

.....

B if there is a short circuit in the lamp? .....

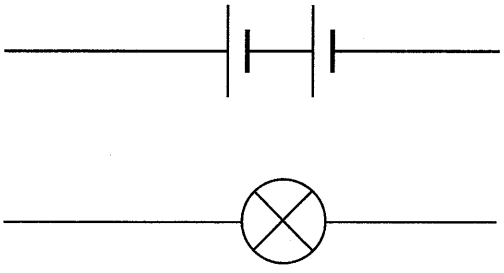
..... **(2)**

(*b*) The pupil is given a replacement bulb and is asked to set up a circuit to measure the power of the bulb.

An ammeter, a voltmeter, some connecting leads and a battery are made available.

(i) Part of the circuit diagram used by the pupil is shown in figure 2.

figure 2



Complete the diagram to show the correct position of the ammeter and voltmeter in the circuit. **(2)**

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13. (*b*) (continued)

(ii) The following readings are observed on the ammeter and voltmeter.

Reading on ammeter = 1·5 A
Reading on voltmeter = 3·0 V

Calculate the power rating of the lamp.

Space for working and answer

(2)

[Turn over

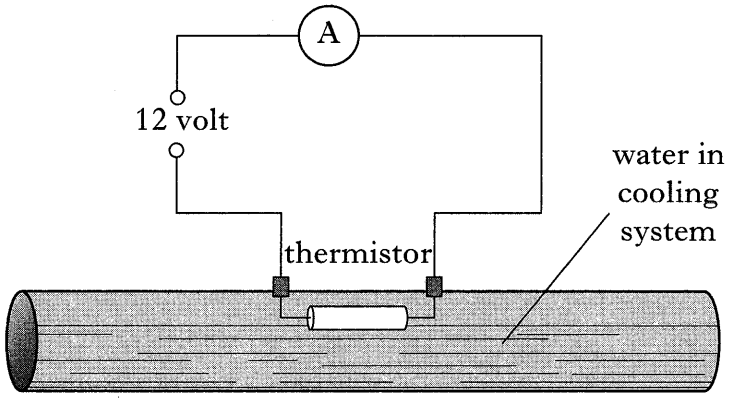
K&U	PS

Marks

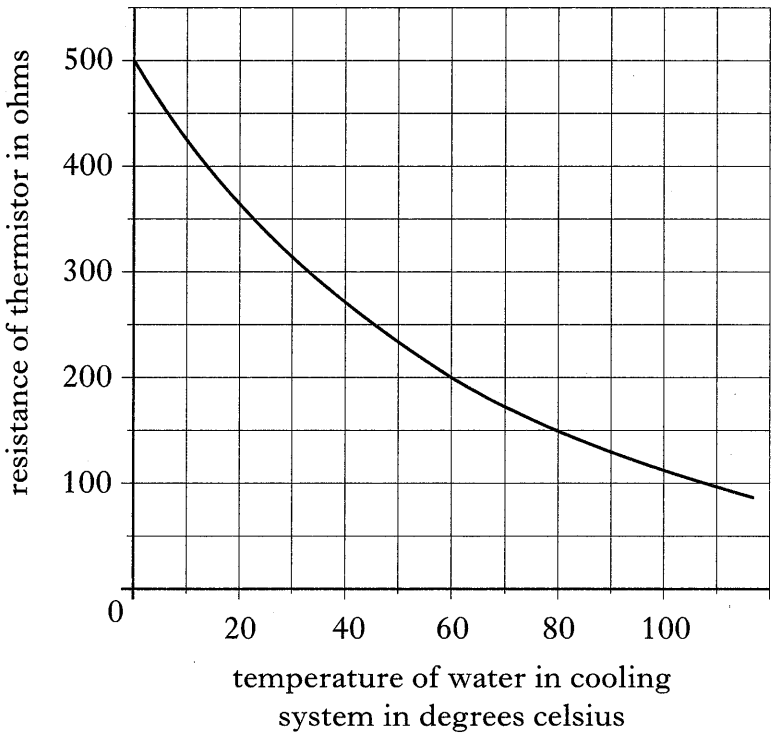
14. Temperature gauges are used in vehicles to give the driver information about the temperature of the water in the engine cooling system.

A temperature gauge is an ammeter with the scale changed to indicate temperature.

The temperature gauge is connected in series with a thermistor in a circuit as shown in the diagram below. The greater the current in the thermistor the higher the temperature reading.



A graph of the resistance of the thermistor against temperature of the water in the cooling system is shown below.



K&U	PS

Marks

14. (continued)

(*a*) Calculate the current in the thermistor when the temperature of the water in the cooling system is 60 °C.

Space for working and answer

(3)

(*b*) Describe how the circuit works.

.....

.....

.....

..... **(2)**

[Turn over

K&U	PS

Marks

15. The table below gives sound levels from different sources of sound.

Source of sound	*Sound level (dB)*
1 metre from a disco loudspeaker	120
5 metres from a pneumatic drill	100
beside a busy motorway	90
inside the cab of a tractor	90
inside a busy supermarket	70
inside a busy office	60
normal conversation	50

When one source of sound is twice as loud as another, the sound level increases by 10 dB.

(*a*) Which of the above sources of sound is twice as loud as the level inside a busy office?

..... **(1)**

(*b*) When working in very noisy surroundings, what precaution should a person take to guard against hearing damage?

..... **(1)**

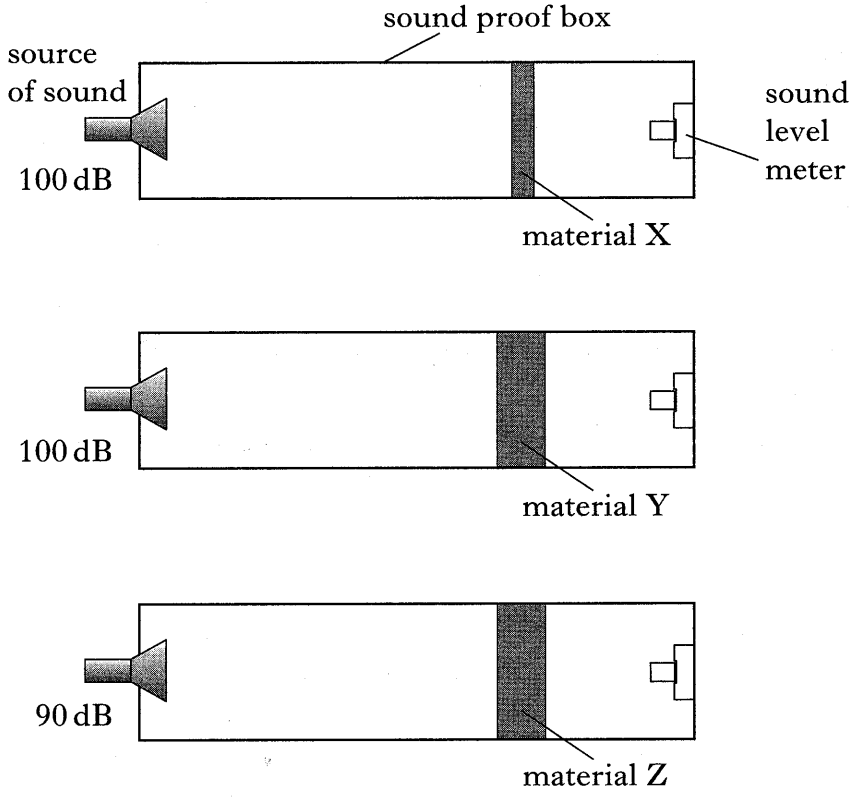
K&U	PS

Marks

15. (continued)

(*c*) A building company wishes to construct a housing estate near to a busy motorway. The company tests three materials X, Y and Z to find out which would be best for soundproofing the walls of their houses.

In the test a sound level meter records the level of sound from a loudspeaker within a soundproof box as shown below.



Give **two** reasons why the test is not a fair one.

1 .....

.....

2 .....

..... **(2)**

[Turn over

K&U	PS

Marks

16. Read the following passage.

The human body maintains a constant temperature of about 37 °C.

Illness can cause body temperature to rise. Death may occur if the temperature rises much above 42 °C (a condition called hyperthermia).

A very low body temperature (a condition called hypothermia) can also be serious. It slows down important chemical reactions in the body and can affect the brain.

Body temperature may be measured using different types of thermometer. Each type has different properties.

For example, mercury in glass thermometers have to be left in the patient's mouth for at least 3 minutes to give an accurate reading.

The accuracy of thermometers using infrared sensors varies with the angle at which they are held, the distance from the patient and the flatness of the skin.

Thermometers using bead thermistors are very accurate, give a reading very quickly but are expensive.

Use the information given in the passage to answer the following questions.

(*a*) Name the condition where the body temperature rises above 42 °C.

..... **(1)**

(*b*) Give **one** disadvantage of using:

(i) a mercury in glass thermometer;

.....

(ii) a thermometer using an infrared sensor.

..... **(2)**

(*c*) Give **one** advantage of a thermometer using a bead thermistor.

..... **(1)**

Marks

17. The stage manager for a school summer show has arranged to borrow some components from the Physics Department.

These components are stored in labelled boxes as shown in figure 1.

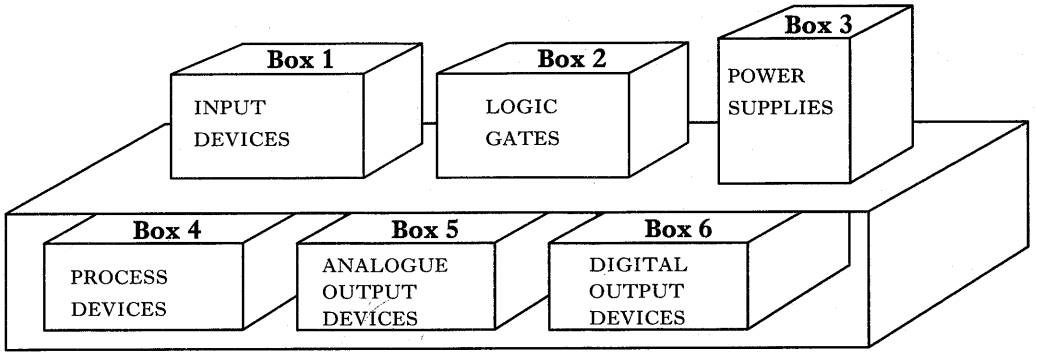


figure 1

(*a*) Complete the following table by inserting the number of the box in which each component will be found.

Component	*Box number*
microphone	
amplifier	
loudspeaker	
transistor	

(2)

(*b*) The stage manager tests an amplifier before using it by connecting it to the microphone and loudspeaker as shown in figure 2. The voltmeters show the input and output voltages.

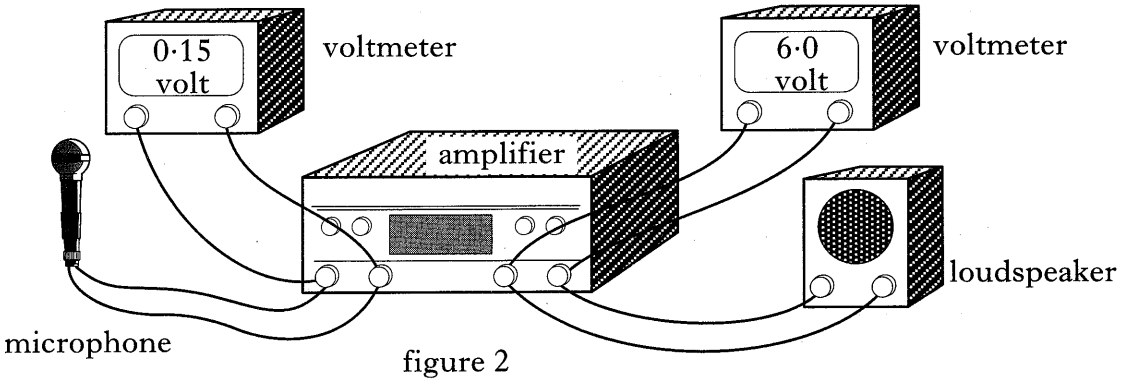


figure 2

Use information from the diagram to calculate the voltage gain of the amplifier.

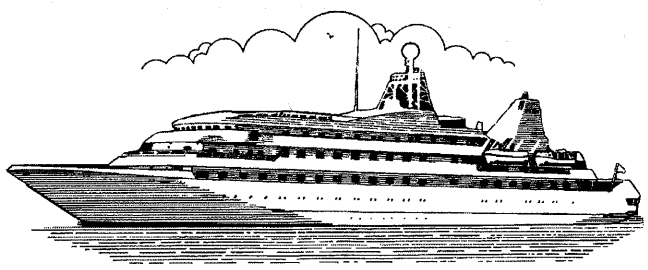
Space for working and answer

(2)

K&U	PS

Marks

18. A car ferry as shown below has a mass of 1 600 000 kilograms.



(*a*) What is the weight of the ferry?

Space for working and answer

(2)

(*b*) The ferry floats at rest in a harbour. The water applies an upward force to the ferry.

Is this upward force greater than, less than or equal to the weight of the ferry?

.....

(1)

(*c*) When the engines are started, the propellers of the ferry apply a force of 100 000 newtons to the ferry.

Calculate the initial acceleration of the ferry.

Space for working and answer

(2)

K&U	PS

Marks

18. (continued)

(*d*) After a few minutes the ferry is travelling at a constant speed of 8 metres per second although the propellers continue to apply a force of 100 000 newtons.

Explain why the ferry travels at constant speed.

.....

..... **(2)**

(*e*) The ferry travels between two islands which are 120 kilometres apart. It maintains an average speed of 8 metres per second during its journey.

Calculate the time taken for the ferry to travel between the two islands.

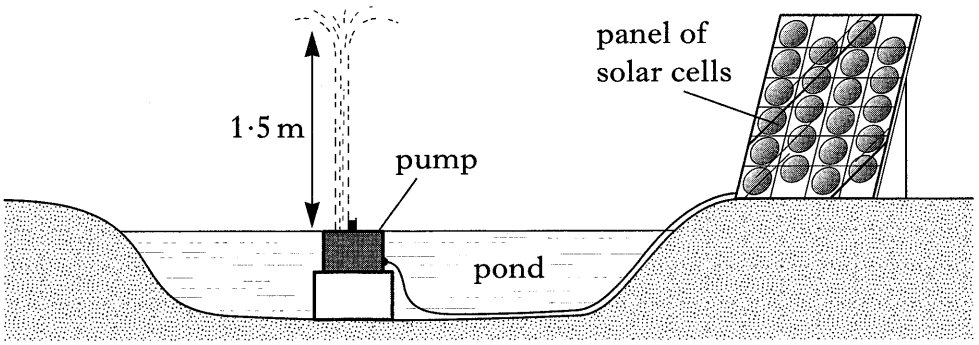
Space for working and answer

(2)

[Turn over

Marks

19. The pump for a fountain in a garden pond is supplied with electrical energy from a panel of solar cells.



(*a*) The pump raises 60 kilograms of water to a height of 1·5 metres in 30 seconds.

(i) Calculate the gravitational potential energy gained by the water in this time.

Space for working and answer

(2)

(ii) What is the minimum power output of the pump motor?

Space for working and answer

(2)

(*b*) State **one** advantage and **one** disadvantage of using the panel of solar cells to operate the pump.

Advantage .....

Disadvantage ..... **(2)**

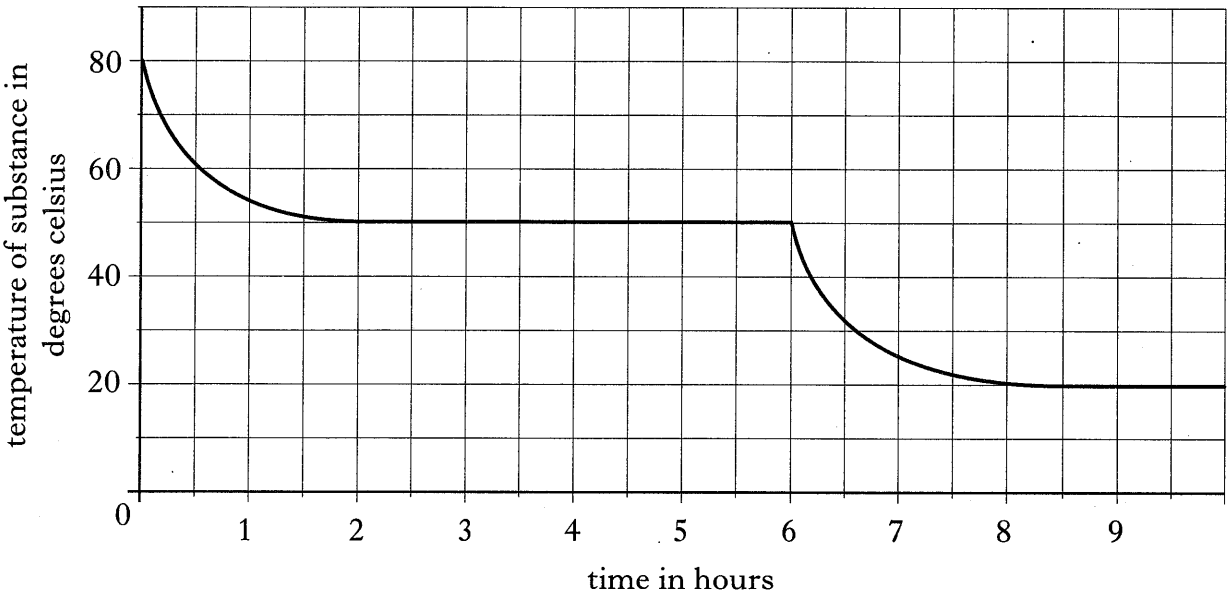
K&U	PS

Marks

20. A hot water bottle is a way of keeping a hospital patient warm. The temperature of the water falls as heat energy is transferred to the patient.

An alternative to the hot water bottle is now available. It is a sealed container holding a substance which changes from solid to liquid when heated. The container is heated in a microwave oven. The container is then placed beside the patient.

The graph below shows how the temperature of the substance in the container then changed with time.



(*a*) How long did the substance remain at 50 °C?

..... **(1)**

(*b*) Although the temperature of the substance did not fall during this time, it could still help to keep a patient warm.

Explain why this happens.

.....

.....

..... **(2)**

(*c*) Suggest why the temperature of the substance did not fall below 20 °C.

.....

..... **(1)**

[Turn over

Marks

21. (*a*) A ray of red light strikes a triangular prism as shown in figure 1.

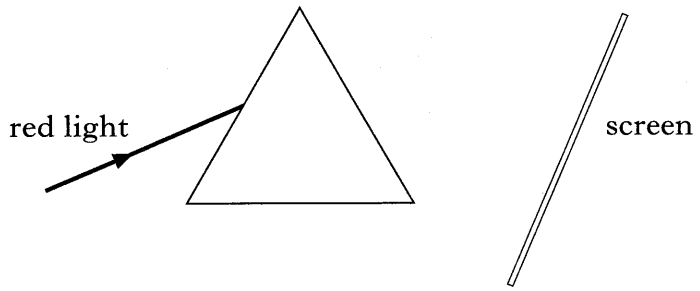


figure 1

(i) Complete figure 1 to show the path of the ray of light as it passes through the prism and on to the screen. **(2)**

(ii) The red light is replaced by a ray of white light.

Describe what would be seen on the screen.

..... **(1)**

(*b*) Astronomers examine light emitted from the elements within stars. The light from each star has its own line spectrum.

Figure 2 shows spectral lines for elements W, X, Y and Z.

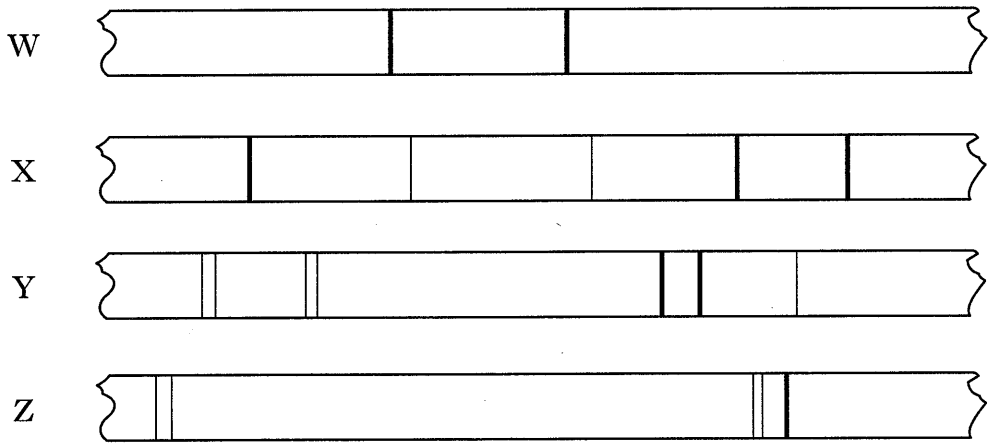


figure 2

"Delta" is a star whose line spectrum is produced by the elements W and Z.

Complete figure 3 to show the line spectrum produced by light from the star "Delta".

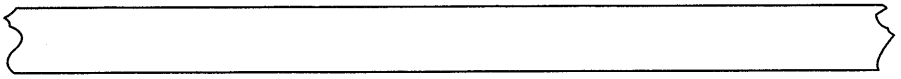


figure 3 **(1)**

K&U	PS

Marks

22. (*a*) Complete the following passage by choosing entries from the following list.

moons universe planets galaxy stars

100 000 days 4·3 years 8 minutes 100 000 years

The Milky Way is the name of our ..... . *It is a collection of about 100 000 million* ..... , *one of which is our Sun. It takes* ..... *for light to travel from the Sun to Earth and* ..... *for light to reach Earth from the edge of the Milky Way.* **(2)**

(*b*) In 1996 a spacecraft was launched on a mission to Mars. The spacecraft re-entered the Earth's atmosphere when it failed to break out of the Earth's orbit.

Describe **two** effects on the spacecraft of the friction forces caused by air resistance on re-entry.

Effect 1 .....

.....

Effect 2 .....

..... **(2)**

[*END OF QUESTION PAPER*]

K&U	PS

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.