G

K & U   PS

Total Marks

3220/144

SCOTTISH CERTIFICATE OF EDUCATION 1995	WEDNESDAY, 17 MAY 9.30 AM – 11.00 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

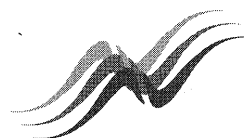Surname

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 1–9, 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 10–28, 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
EXAMINATION
BOARD

Marks

1. TV signals are sent from Britain to the USA using a satellite link. The device which sends the signals from Britain is called the

    A   modulator

    B   decoder

    C   loudspeaker

    D   amplifier

    E   transmitter.

    Answer [　]   **(1)**

2. Electrical signals travel in telephone wires at a speed which is

    A   less than the speed of sound

    B   almost equal to the speed of sound

    C   almost equal to the speed of light

    D   greater than the speed of light

    E   greater than the speed of radio waves.

    Answer [　]   **(1)**

3. The circuit diagram shows a lamp, a motor and a resistor connected in series to a supply. The voltage across each component is shown on the diagram.

    The voltage of the supply is

    A   2 volts

    B   4 volts

    C   6 volts

    D   10 volts

    E   32 volts.

    Answer [　]   **(1)**

4. Which of the following shows the correct path of a ray of light passing through air and into a block of glass?

A

B

C

D

E
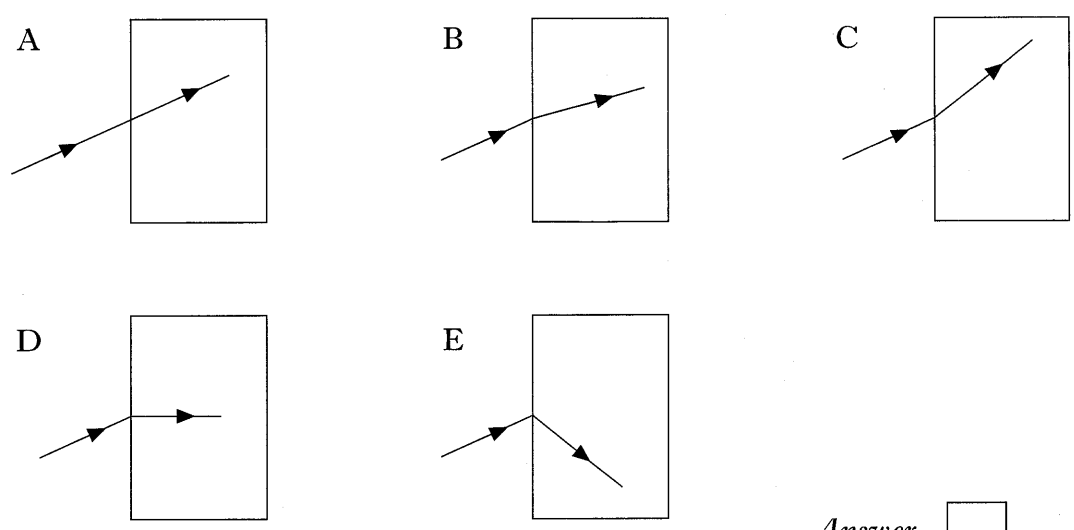
Answer ☐ **(1)**

5. The diagram shows how far two radiations X and Y from a radioactive source will travel when sheets of paper, aluminium and lead are placed in front of the source.

source

X

Y

paper   2 mm
aluminium

2 cm lead
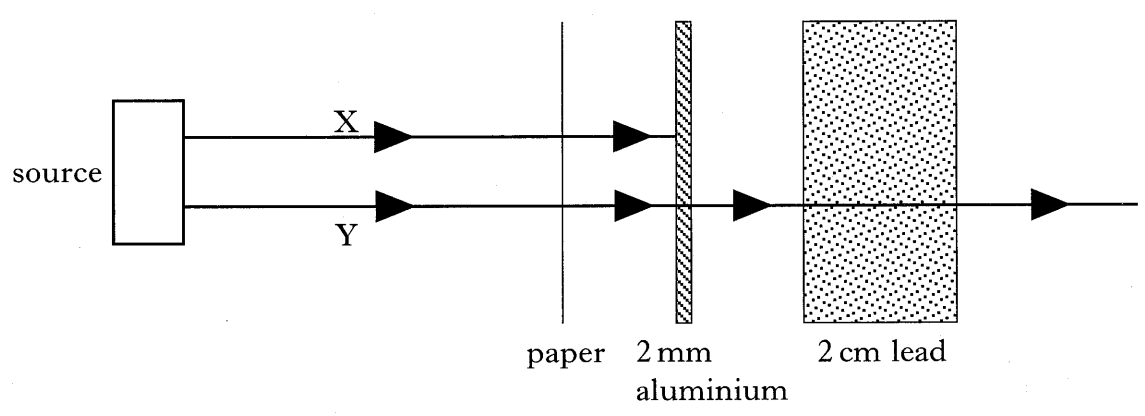
Which of the following correctly names both the radiations X and Y?

	Radiation X	*Radiation Y*
A	alpha	beta
B	alpha	gamma
C	beta	gamma
D	beta	alpha
E	gamma	beta

Answer ☐ **(1)**

6. In the circuit shown below, a voltmeter is connected across an unknown component X. When switch S is closed, the reading on the voltmeter rises very slowly to a maximum value.
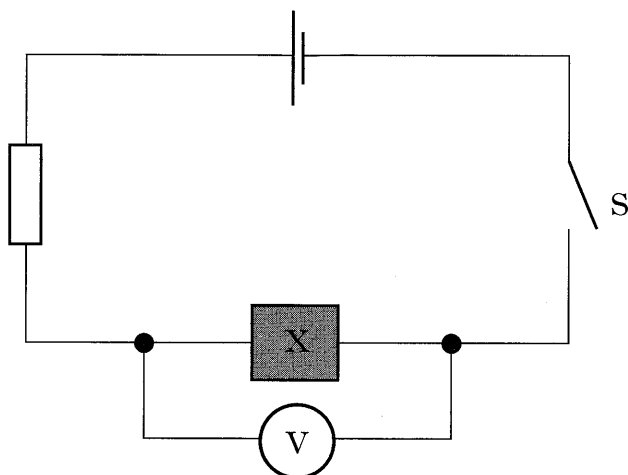
Which of the following components is X?

A   Capacitor

B   Resistor

C   Bulb

D   Diode

E   LED

Answer ☐   **(1)**

7. When a material is changing state from a solid to a liquid, the temperature of the material

A   increases

B   decreases

C   remains constant

D   falls then rises

E   rises then falls.

Answer ☐   **(1)**

8. The time taken for light to travel from the Sun to the Earth is approximately

A   8 seconds

B   8 minutes

C   24 hours

D   365 days

E   4·5 years.

Answer ☐   **(1)**

9. Object X of mass 1 kilogram and object Y of mass 10 kilograms are dropped from the same height. Both objects fall freely. Object X accelerates at 10 metres per second per second.

The acceleration of object Y, in metres per second per second, is

A 0·1

B 1·0

C 10

D 100

E 1000.

Answer ☐   **(1)**

10. In the space below, draw the circuit symbol for a transistor.

Space for symbol

(1)

11. An atom is made up from protons, neutrons and electrons.

On the simple diagram of an atom shown below, complete the labels to show where each of these particles may be found.

(1)

12. A mountaineer of mass 70 kilograms climbs through a height of 900 metres. Calculate the gain in the mountaineer's potential energy.

Space for working and answer

(2)

13. (a) Three methods of telecommunication are listed below.

radio   *television*   *Morse code telegraph*

In which one of these methods **must** the transmitter and receiver be linked by wire?

.... **(1)**

(b) Another method of telecommunication is by mobile phone. This method involves signals being carried by a wave rather than being sent along wires.

State the type of wave which carries the signal from one mobile phone to another.

.... **(1)**

Marks

14. The block diagram below shows the main parts of a TV. The labels in two of the blocks are missing.

```
                    ┌─────────┐
                    │ Aerial  │
                    └────┬────┘
                         │
                    ┌────┴────┐
                    │  Tuner  │
                    └────┬────┘
          ┌──────────────┴──────────────┐
   ┌──────┴───────┐              ┌───────┴──────┐
   │ Vision decoder│              │ Sound decoder│
   └──────┬───────┘              └───────┬──────┘
   ┌──────┴───────┐              ┌───────┴──────┐
   │  Amplifier   │              │  Amplifier   │
   └──────┬───────┘              └───────┬──────┘
   ┌──────┴───────┐              ┌───────┴──────┐
   │              │              │              │
   └──────────────┘              └──────────────┘
```
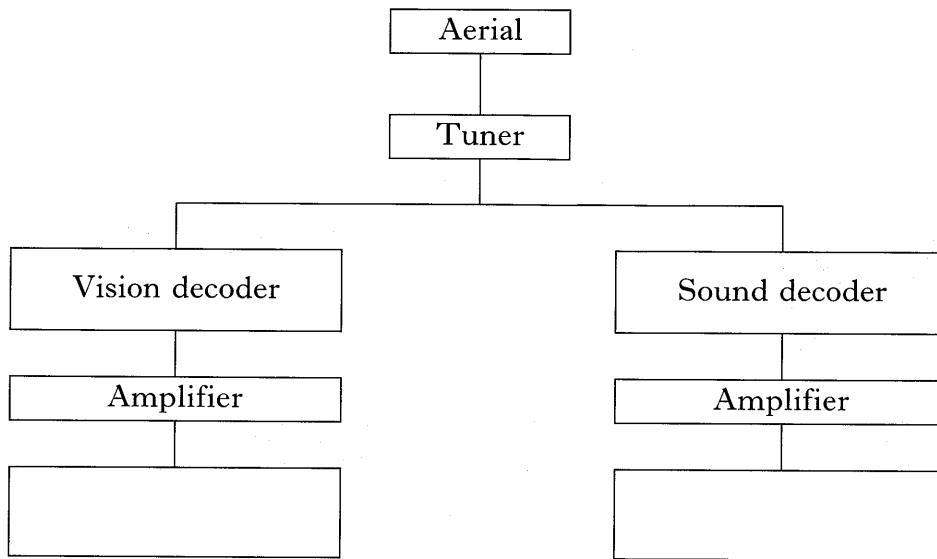
(*a*) Complete the block diagram by filling in the missing labels. **(1)**

(*b*) What is the purpose of the tuner?

.... **(1)**

(*c*) Name the **three** colours used to produce colour TV pictures.

(1) ....   (2) ....   (3) .... **(1)**

15. The table below gives some information about satellites W, X, Y and Z which orbit the Earth. The time for satellite Y to orbit the Earth is missing from the table.

Satellite name	Average height above the Earth	Time to orbit the Earth
W	35 800 km	24 hours
X	3 000 km	2 hours 30 min
Y	15 000 km	▓▓▓▓▓▓▓▓
Z	300 km	1 hour 30 min

(*a*) Which one of the following is a possible time for satellite Y to orbit the Earth?

(A) 1 hour   (B) 2 hours   (C) 8 hours 30 min   (D) 30 hours 30 min

.... **(1)**

(*b*) Which of the satellites in the table is a geostationary satellite?

.... **(1)**

Page seven   **[Turn over**

16. A pupil uses a Geiger-Muller tube and a counter to measure the activity of the background radiation in the laboratory. The counter is switched on for a certain time and a count is recorded. The pupil records the time on a stopclock. The readings obtained are shown on the diagram below.

stopclock

01 25

04 : 10
MIN   SEC

counter

Geiger-Muller tube
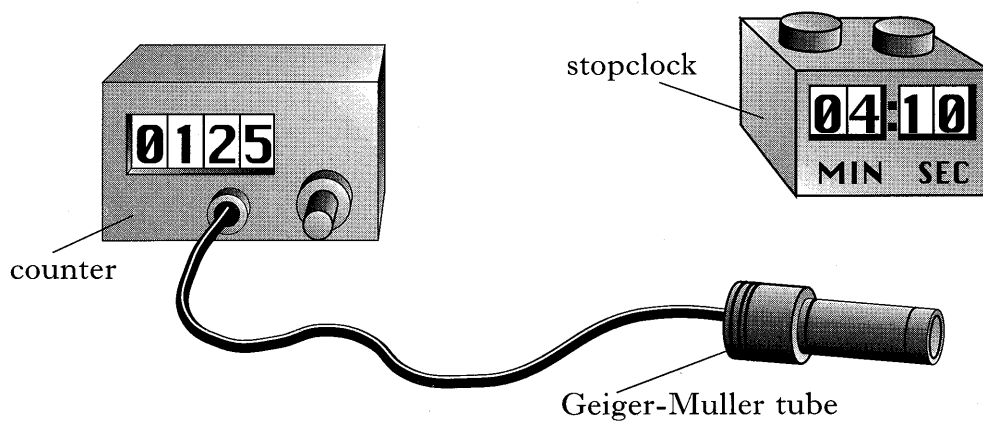
Calculate the activity of the background radiation.

Space for working and answer

(2)

17. A portable lamp contains a filament bulb and a fluorescent tube as shown. Either can be switched on but not at the same time.

filament bulb

fluorescent tube
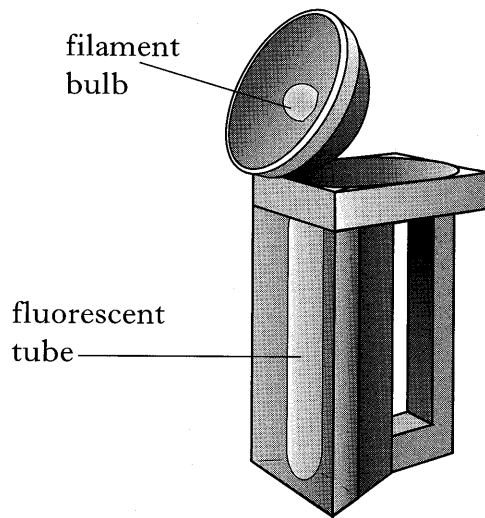
(*a*) The filament bulb is rated at 6 volts, 9 watts.

(i) Calculate the current in the bulb when it is operating at its stated rating.

Space for working and answer

(2)

(ii) Only 3% of the electrical power is used to produce light in the filament bulb.

What is produced by the remaining electrical power?

.... **(1)**

(*b*) The filament bulb is switched off and the fluorescent tube is now switched on for the same time. The fluorescent tube is also rated at 6 volts, 9 watts.

(i) What difference, if any, would there be in the amount of light energy produced by the lamp?

.... **(1)**

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

....

.... **(1)**

Marks

18. A variable resistor is used in the speed controller for a model railway engine. The variable resistor controls the current in the motor of the model engine. The motor is connected in series with the variable resistor and supply as shown below.

speed
controller

(*a*) At one particular speed, the voltage across the variable resistor is 4 volts and the current in it is 0·5 ampere.

   (i) Calculate the resistance of the variable resistor.

Space for working and answer

(2)

   (ii) What is the value of the current in the **motor**?

.... **(1)**

(*b*) The resistance of the variable resistor in the speed controller is increased. State what happens to the speed of the train. Give a reason for your answer.

....

.... **(2)**

(*c*) Give **one** other practical use for a variable resistor.

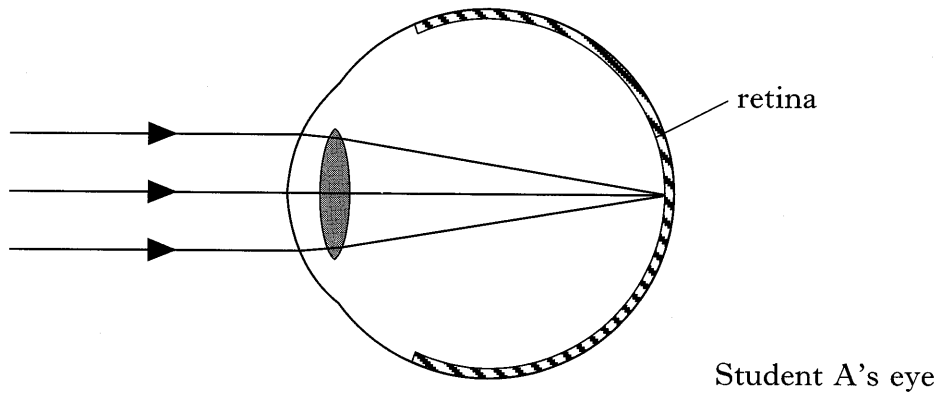.. **(1)**

19. Two students, A and B, are looking at the same distant object. Student A is able to see the object clearly. Student B has a sight defect and is unable to see the object clearly.

The diagram below shows the path of rays of light, from the distant object, entering student A's eye.

retina

Student A's eye

(*a*) Complete the following diagram to show what happens to the light rays in student B's eye.

retina
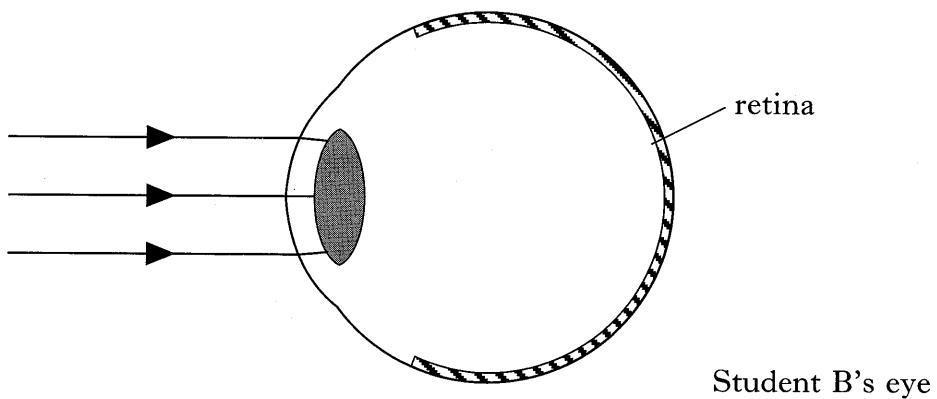
Student B's eye **(1)**

(*b*) By referring to your diagram, explain why the image on the retina of student B's eye is blurred.

....

.... **(1)**

(*c*) Name this sight defect.

.... **(1)**

(*d*) In a normal eye, the image on the retina is smaller than the object being viewed.

State **one** other difference in the image compared to the object viewed.

.... **(1)**

Marks

20. The table below lists the upper and lower frequency limits which apply to the hearing range of different animals.

Animal	Frequency of lower limit of hearing (hertz)	Frequency of upper limit of hearing (hertz)
Elephant	20	10 000
Finch	100	15 000
Cat	30	45 000
Dog	20	30 000
Human	20	17 000
Whale	40	80 000

(a) What is the highest frequency which can be heard by a cat?

.... **(1)**

(b) A dog whistle emits sound which can be heard by a dog but not by a human.

Using information from the table, state **one** possible frequency of the sound emitted by the dog whistle.

.... **(1)**

(c) Name **two** animals in the table, apart from humans, which will not respond to ultrasound.

Animal (1) ....

Animal (2) ....   **(1)**

(d) Choose the lowest frequency of sound which can be heard by a whale and calculate the wavelength of this sound in water.

(Speed of sound in water = 1410 metres per second)

Space for working and answer

(2)

21. An intercom system is used so that parents can hear a baby crying in the bedroom.

The block diagram for the system is shown below.

| INPUT DEVICE X |—————| AMPLIFIER |—————| OUTPUT DEVICE Y |

In baby's bedroom   In parents' room

(*a*) Which of the following devices would be suitable as the input device X and the output device Y for the system?

      loudspeaker   *bulb*   *microphone*   *LED*

(i) X .... **(1)**

(ii) Y .... **(1)**

(*b*) The output signal from the amplifier is displayed on an oscilloscope and is shown below.

(i) Signals may be classified as digital or analogue.

Which type is the above signal?

.... **(1)**

(ii) When the input signal to the amplifier has a value of 0·01 volt, the value of the output signal is 1·5 volts.

Calculate the voltage gain of the amplifier.

Space for working and answer

(2)

22. (*a*) During her Physics lesson, Heather sets up the following series circuit.

6 volt battery

LED

resistor
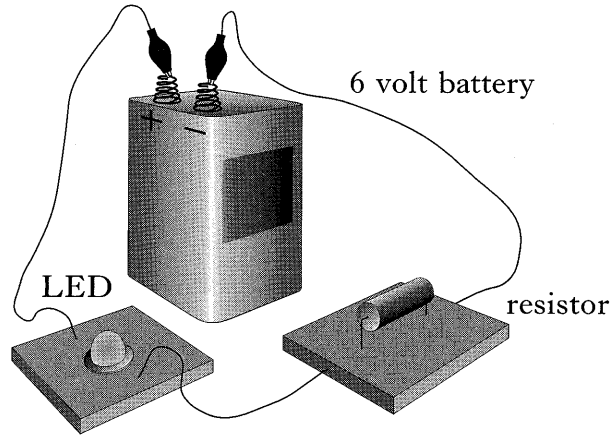
The light emitting diode (LED) is rated at 2 volts and lights at normal brightness.

Heather dismantles the circuit and her partner Hamish attempts to connect up the same circuit using the same equipment. Hamish connects the battery, LED and resistor in series but finds that the LED will not light even although all the connections and equipment are in good working order.
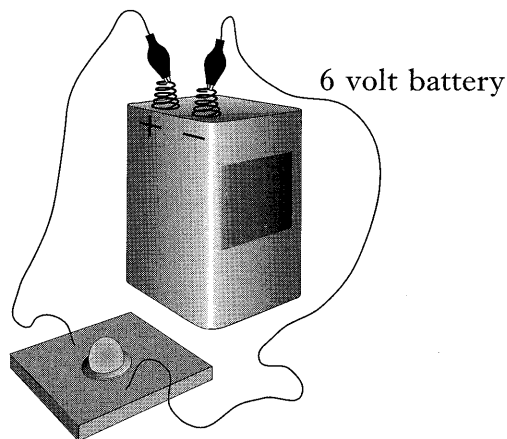
There are two possible mistakes Hamish could have made which caused the LED to remain off.

Name the **two** mistakes.

Mistake (1) ....

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

(*b*) In another group in the class, Iain connects up a circuit in the same way as Heather but without the resistor.

6 volt battery

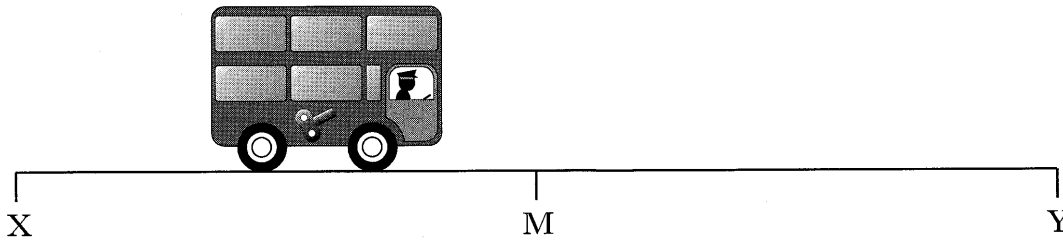(i) What effect does this have on the LED?

.... **(1)**

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

.... **(1)**

23. In the Physics laboratory, some pupils are measuring the average speed of a toy clockwork bus by measuring the time it takes to travel from X to Y as shown.

X   M   Y

(*a*) The distance between X and Y is 75 centimetres. In one run, the time taken to go from X to Y is 1·5 seconds.

Calculate the average speed of the toy bus in metres per second.

> *Space for working and answer*

(2)

(*b*) The pupils were asked to measure the speed of the toy bus at a point M mid-way between X and Y. They were supplied with a metre stick and a light gate connected to a timer.

Describe how the pupils could measure the speed of the toy bus at the midway point M.

....

....

....

....

....

....

.... **(3)**

Marks

24. The table below gives some information about the performance of three cars A, B and C.

Car	A	B	C
Top speed in miles per hour	116	116	122
Time in seconds to accelerate from 0 to 60 miles per hour	12	10	10
Acceleration (from 0 to 60 miles per hour) in miles per hour per second	▓▓▓▓	6	6

(a) The value for the acceleration of car A as it travels from 0 to 60 miles per hour has not been entered in the table.

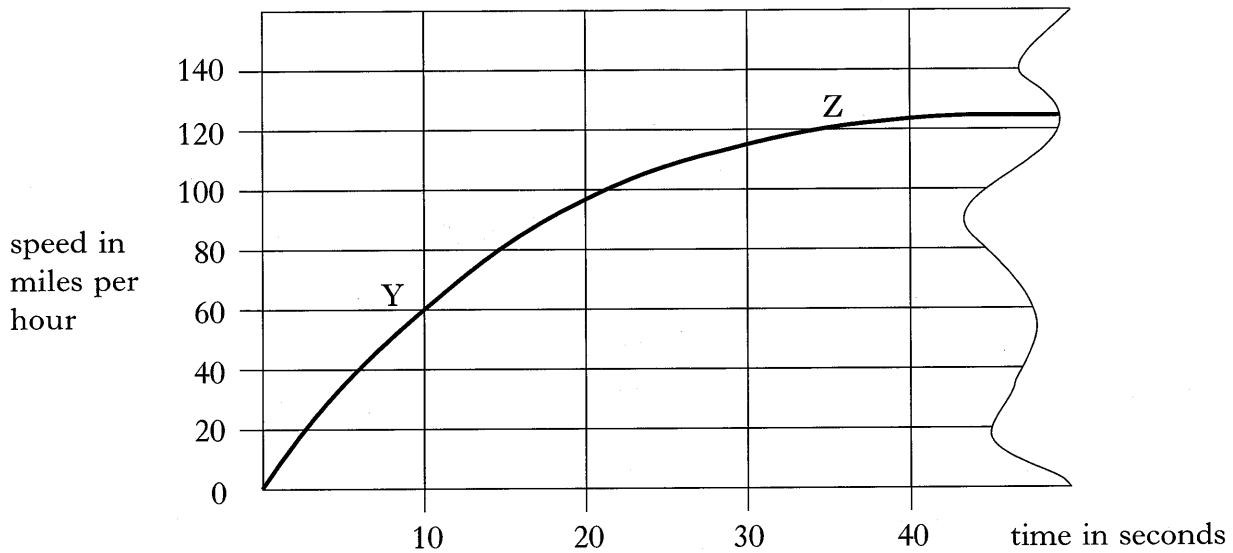Calculate the missing acceleration for car A.

Space for working and answer

(2)

24. (continued)

(*b*) One of the cars takes part in a trial run on a race track. The speed–time graph for the motion is shown below.

(i) Identify the car whose motion is represented by the graph. Explain your choice.

....

.... **(2)**

(ii) Describe the motion of the car between Y and Z on the graph.

.... **(1)**

(*c*) The values given in the car performance table are for cars carrying no passengers.
What effect would carrying passengers have on the time taken to accelerate from 0 to 60 miles per hour?

.... **(1)**

[Turn over

25. (*a*) The diagram shows the percentage of heat lost through various parts of a house.

roof
25 %

windows
10 %

wall and
floors
45 %
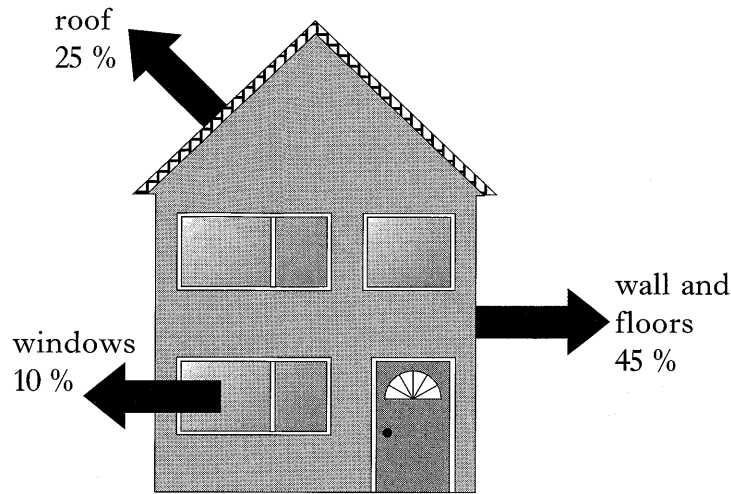
All the remaining heat lost from the house is due to draughts.

What percentage of heat is lost due to draughts?

Space for working and answer

(1)

(*b*) The rate at which heat is lost by conduction from a house can be reduced by installing double glazing.

A typical double glazed window allows 60 joules of heat to pass through each square metre every second.

(i) For one particular window, 300 joules of heat pass through every second.

Calculate the area of the window.

Space for working and answer

(2)

(ii) Describe another way of reducing heat loss by conduction from a house.

.... **(1)**

Marks

25. (continued)

(*c*) Gas can be used as a fuel for heating a house. Gas is an example of a fossil fuel.

Explain briefly why it is important to cut down on the amount of fossil fuel which is being used to produce heat.

....

....

.... **(2)**

(*d*) Some sources of energy are listed below.

coal   waves   wind   oil

Complete the table below to show which of these sources are renewable and which are non renewable.

Renewable	Non renewable

(1)

[Turn over

Marks

26. (*a*) A bulb used in an overhead projector requires a 12 volt supply. A transformer inside the projector steps down the 240 volts from the mains supply to 12 volts.
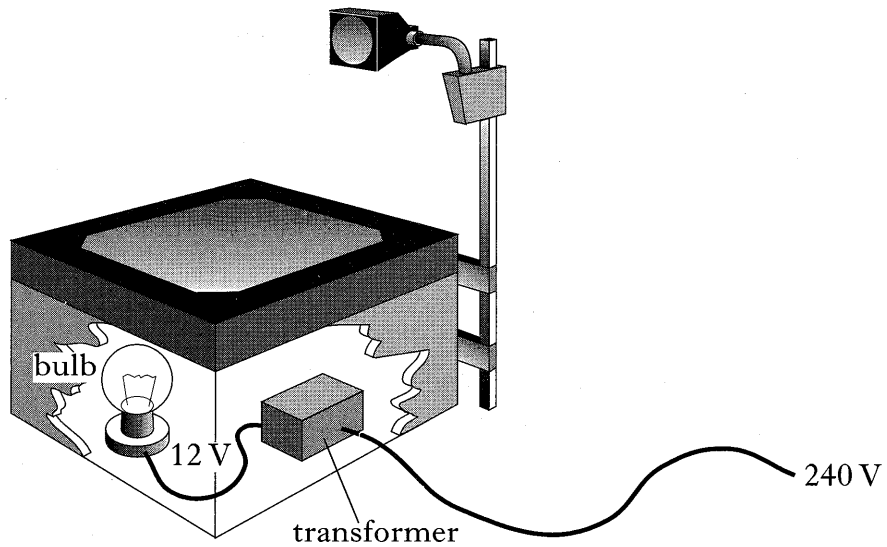
The transformer has 1000 turns in its primary coil.

Calculate the number of turns in its secondary coil.

Space for working and answer

(2)

(*b*) Explain why a transformer cannot be used to step down the voltage from a battery.

....

.... **(2)**

27. (*a*) Complete the following passage by inserting the missing words.

In our solar system there are nine .... orbiting the Sun. Venus and Mercury are both closer to the Sun than Earth. The closest star to the Earth apart from the Sun is Proxima Centauri. The Sun and most of the stars we can see belong to a group of stars called the Milky Way. By looking through telescopes we can see other groups of stars. One such group is called Andromeda. The name given to all space which contains all of the groups of stars is the .... **(2)**

(*b*) Using the information given in the passage, state the names of **two** galaxies.

.... **(2)**

28. Kirsty investigates the properties of light by setting up an experiment as shown below.

The colours appear on the screen in order of wavelength.

(*a*) What name is given to the effect on the light as it enters the glass?

.... **(1)**

(*b*) List the colours green, blue and red in order of wavelength, starting with the shortest wavelength.

.... **(1)**

(*c*) State **one** colour, listed on the diagram, which has a higher **frequency** than blue.

.... **(1)**

[END OF QUESTION PAPER]

K&U PS

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

K&U	PS