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13 A musician plays an electric guitar.

The guitar produces varying currents that pass into a loudspeaker.

Some of the workings of a loudspeaker are shown in Fig. 13.1.

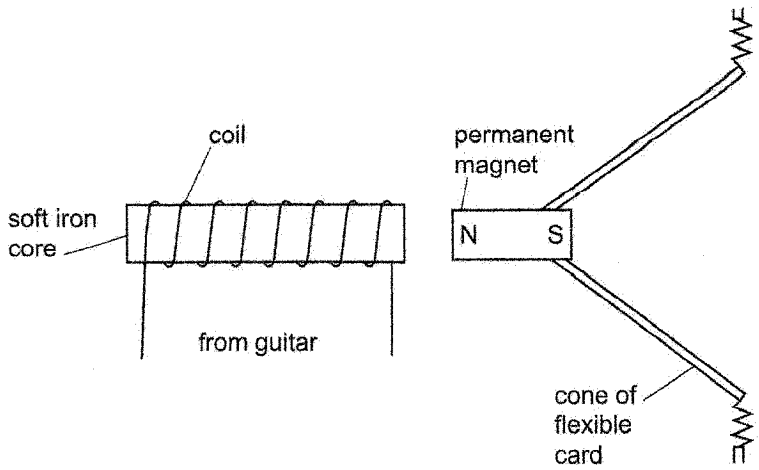


Fig. 13.1

A coil of wire is wrapped around a soft iron core. The core is held close to, but not touching, a permanent magnet that is attached to a cone of flexible card. The card is able to move when the permanent magnet moves.

(a) Soft iron is a magnetic material. Explain why it is attracted to the permanent magnet even when there is no current in the coil.

.....

.....

..... [2]

(b) The coil of wire wound onto the soft iron core now has a current in it.

The current in the coil causes the soft iron core to repel the permanent magnet.

Explain why the core repels the permanent magnet.

.....

.....

.....

..... [2]

(iii) A simplified model of an electric motor is shown in Fig. 12.2.

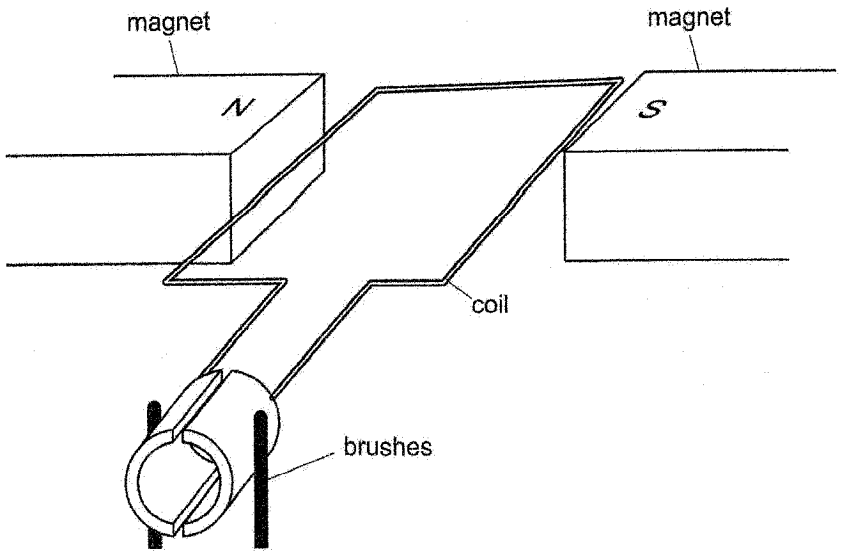


Fig. 12.2

Explain how a current in the coil of the motor causes the coil to turn.

You may wish to add to Fig. 12.2 to help in your explanation.

.....

.....

.....

.....

..... [3]

[Total: 10]

12 A solar farm consists of many solar cells that generate an electromotive force (e.m.f.) when electromagnetic radiation from the Sun is incident on them.

(a) State the region of the electromagnetic spectrum that causes the solar cells to generate an e.m.f.

..... [1]

(b) The solar farm generates energy only during the day.

Energy generated during the day that is not used can be stored so that it may be used at night.

To store the energy, a crane lifts blocks of concrete as shown in Fig. 12.1.

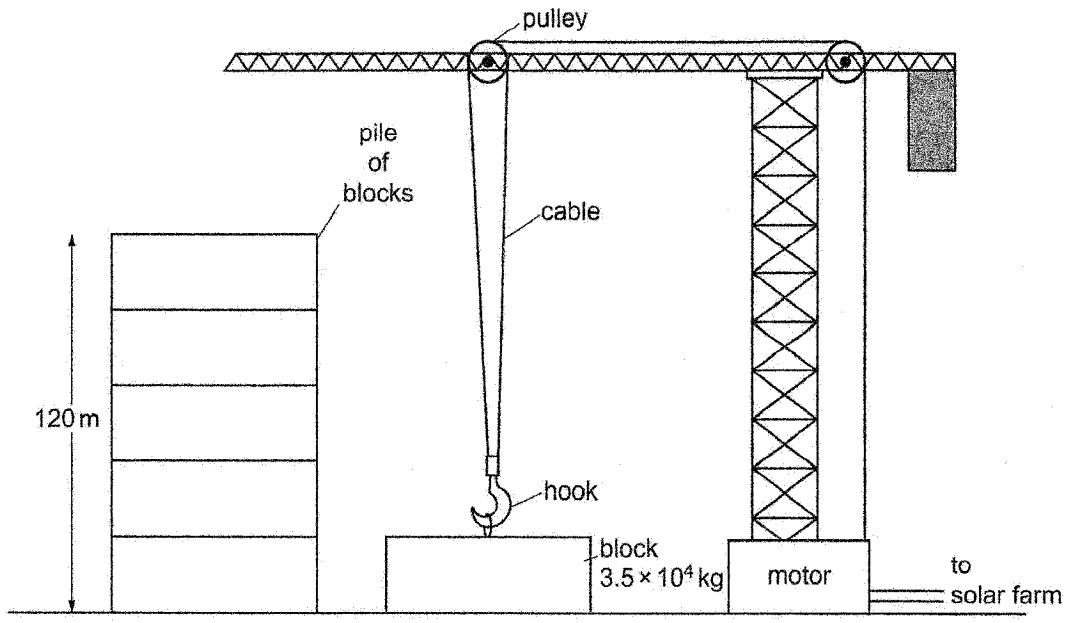


Fig. 12.1

Energy from the solar farm powers the motor on the crane to lift each block.

Each block has a mass of 3.5×10^4 kg.
One block is raised through a height of 120 m in 1.5 minutes.
The gravitational field strength is 10 N/kg.

SECTION B

Answer any **two** questions.

Write your answers in the spaces provided.

11 **(a)** A water heater heats water in an insulated container, as shown in Fig. 11.1.

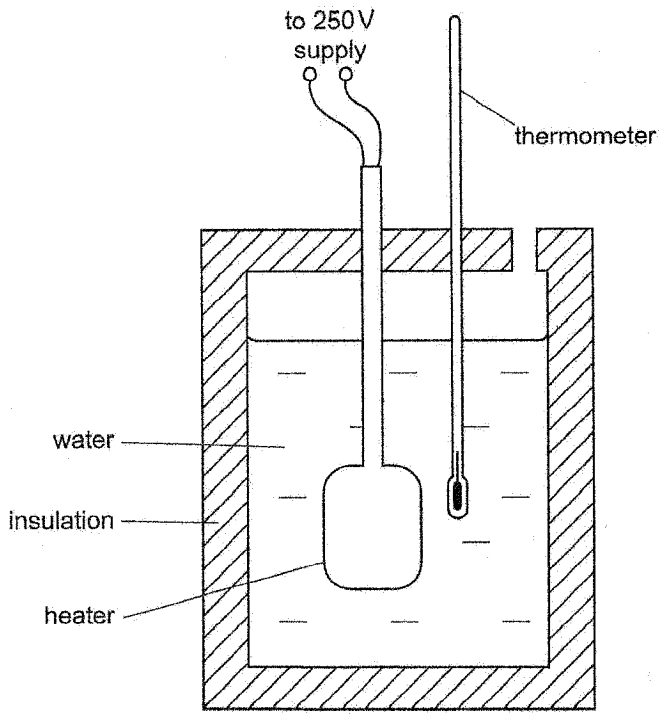


Fig. 11.1

The current in the heater is 6.0 A when the voltage of the supply is 250 V.

The temperature of the water is taken every minute for 13 minutes and a graph is plotted to show the variation with time of temperature. The graph obtained is shown in Fig. 11.2.

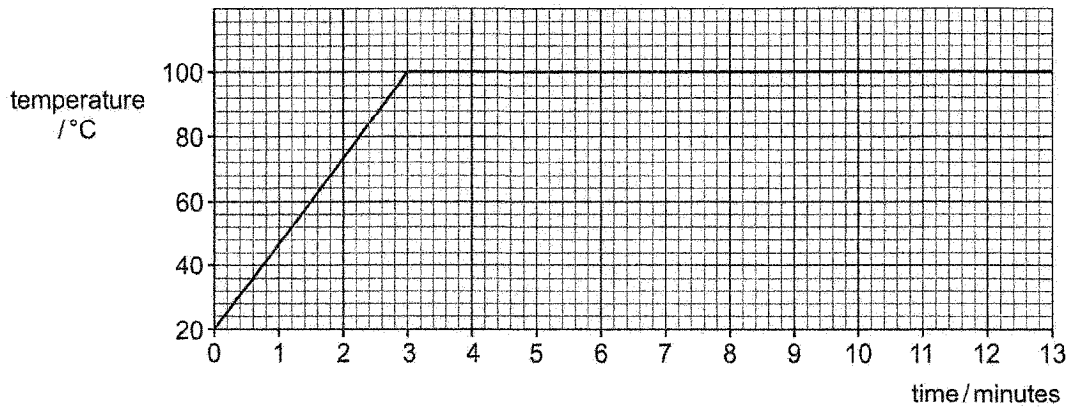


Fig. 11.2

10 A decoration consists of three identical lamps connected in series with each other and with a resistor that protects them from damage.

The decoration is connected in series to a 9.0 V supply as shown in Fig. 10.1.

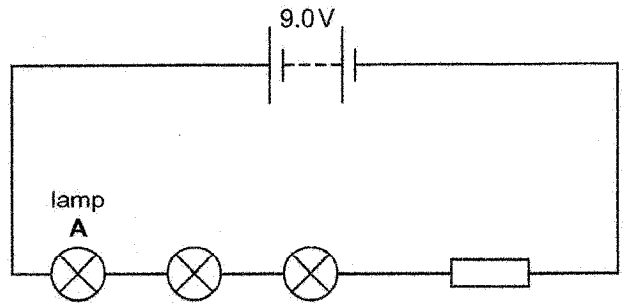


Fig. 10.1

The variation of current in each lamp with the potential difference (p.d.) across it is shown in Fig. 10.2.

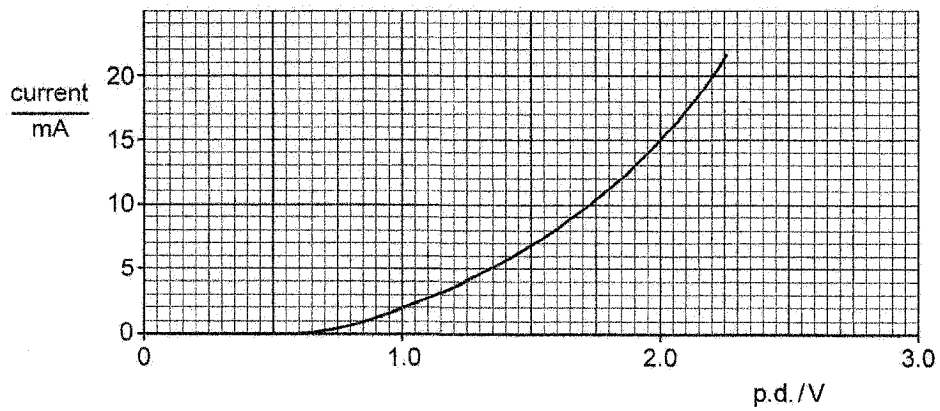


Fig. 10.2

(a) The current in lamp **A** is 15 mA.

(i) Use Fig. 10.2 to determine the potential difference (p.d.) across lamp **A**.

p.d. = ... V [1]

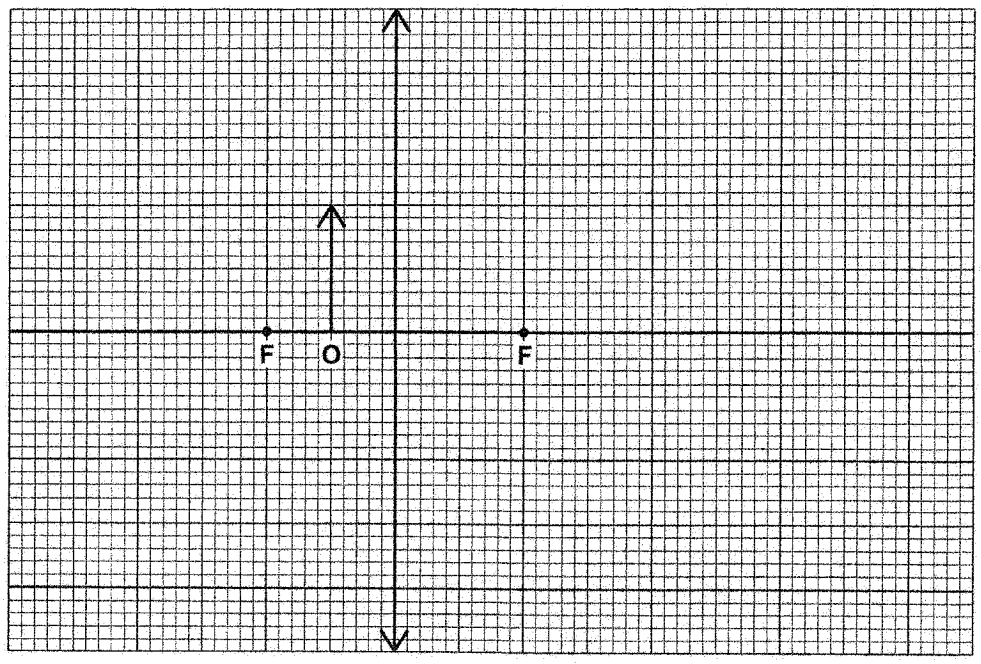
(ii) Calculate the potential difference (p.d.) across the resistor.

p.d. = ... V [1]

(iii) Calculate the resistance of the resistor.

resistance = ... Ω [2]

(b) Object **O** is now moved so that it is 5.0 cm from the lens, as shown in Fig. 8.2.



Scale: 1 cm represents 5 cm

Fig. 8.2

State how the image now formed differs from the image formed in **(a)**.

You may draw on Fig. 8.2 if you wish.

.....

.....

..... [3]

[Total: 8]

7 **(a)** State what is meant by an electric field.

.....

..... [1]

(b) Some students were asked to draw a diagram of the electric field in the region near an isolated point negative charge. Some of their answers are shown in Fig. 7.1.

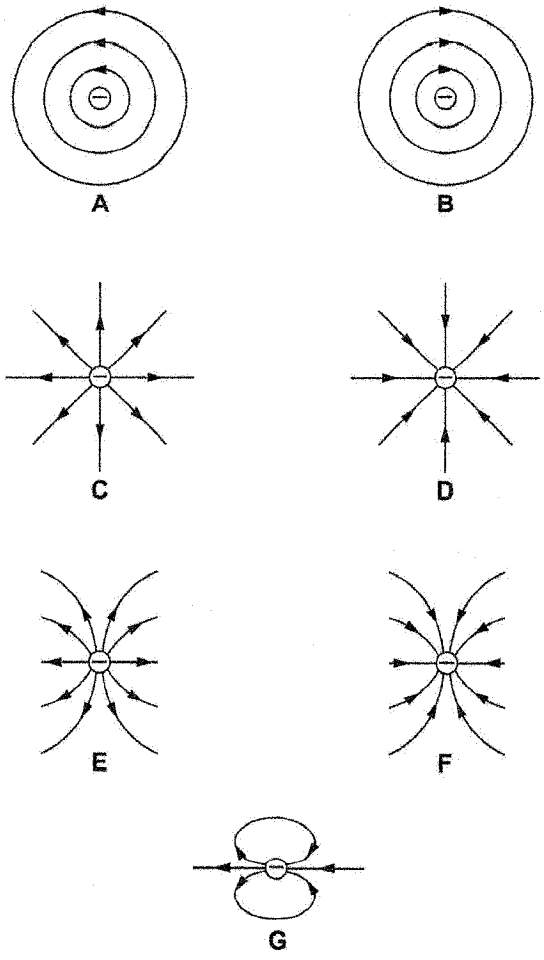


Fig. 7.1

State the letter of the correct diagram.

..... [2]

[Total: 3]

5 A DVD player uses blue laser light. Some other DVD players use red laser light.

Most DVD players have a remote control that uses infra-red light.

Table 5.1 contains some information about blue laser light and infra-red light.

Table 5.1

property	infra-red light	blue laser light	red laser light
speed in vacuum		3.0×10^8 m/s	
wavelength in vacuum	900 nm	450 nm	
frequency in vacuum	3.3×10^{14} Hz	6.7×10^{14} Hz	

Complete Table 5.1 with:

(a) values for speed in vacuum for infra-red light and for red laser light [1]

(b) possible values for wavelength and frequency of red laser light. [1]

[Total: 2]

4 A horizontal force of 15N, applied to the handle, is needed to raise the platform of an empty trolley, as shown in Fig. 4.1.

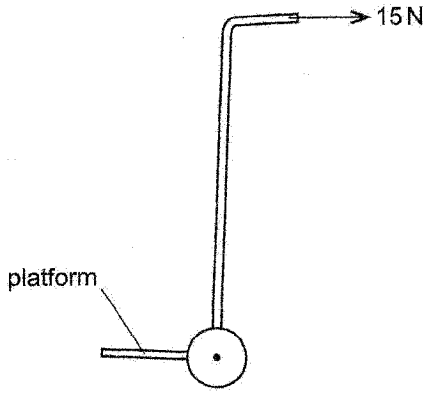


Fig. 4.1

A suitcase is placed on the platform of the trolley, as shown in Fig. 4.2.

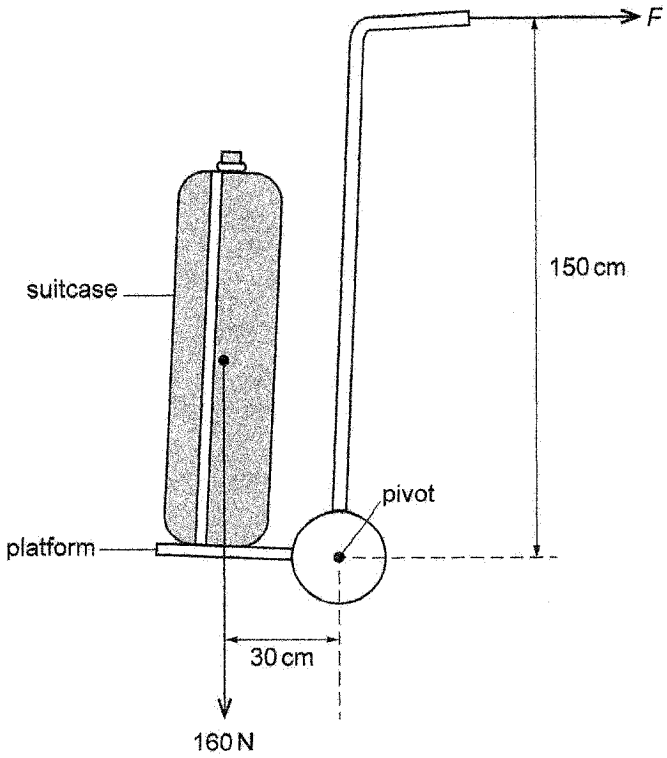


Fig. 4.2

3 A sled is pulled by two dogs across a snowfield, as shown in Fig. 3.1.

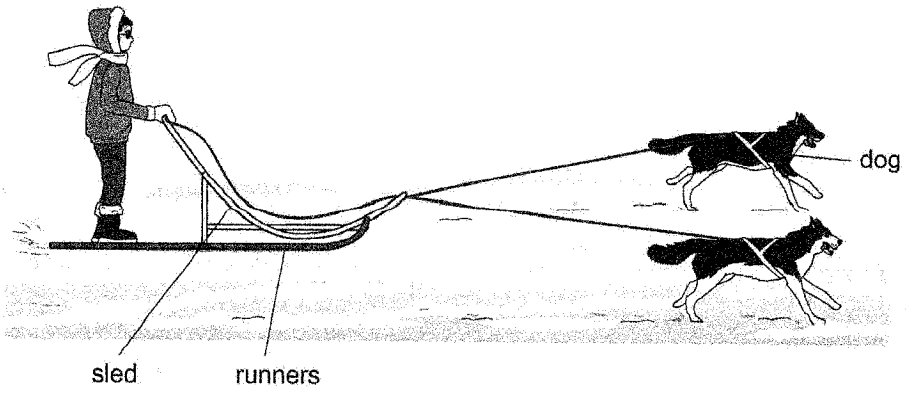


Fig. 3.1

(a) One dog pulls on a rope with a force of 55 N. The other dog pulls on a second rope with a force of 65 N, as shown in Fig. 3.2.

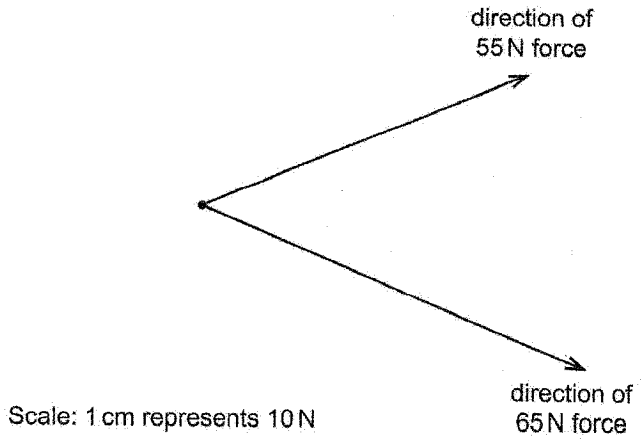


Fig. 3.2

The angle between the two ropes is as shown in Fig. 3.2.

On Fig. 3.2, draw a vector diagram to determine the magnitude of the resultant force produced by the two dogs.

Use a scale in which 1 cm represents a force of 10 N.

magnitude of resultant force = ... N [3]

SECTION A

Answer **all** the questions in the spaces provided.

1 **(a)** Circle the number in the list below that is equal to the number of milligrams (mg) in 1.0 kilogram (kg).

1.0×10^2 1.0×10^3 1.0×10^4 1.0×10^5 1.0×10^6

[1]

(b) Table 1.1 shows some units that may be used to measure physical quantities.

Table 1.1

physical quantity	unit
electrical resistance	ohm (Ω)
	newton per metre squared (N/m^2)
	ampere second (As)

Complete Table 1.1 to show the physical quantity that is measured in each of the listed units. The first one has been done for you.

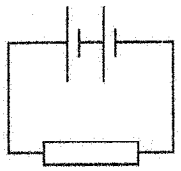
[2]

[Total: 3]

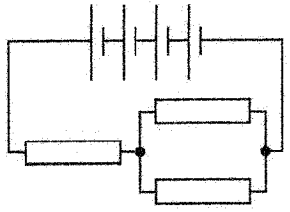
19 The circuits contain a number of identical cells and a number of identical resistors.

In which circuit is the current in the cells the highest?

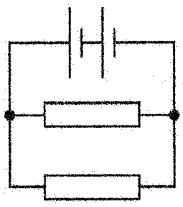
A



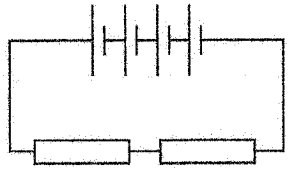
B



C



D



20 A piece of magnetised steel is placed inside a coil connected to a power supply.

Which method demagnetises the steel?

A Supply alternating current and gradually decrease the voltage to zero.

B Supply alternating current and gradually increase the voltage from zero.

C Supply direct current and gradually decrease the voltage to zero.

D Supply direct current and gradually increase the voltage from zero.

13 Some of the components of the electromagnetic spectrum are shown.

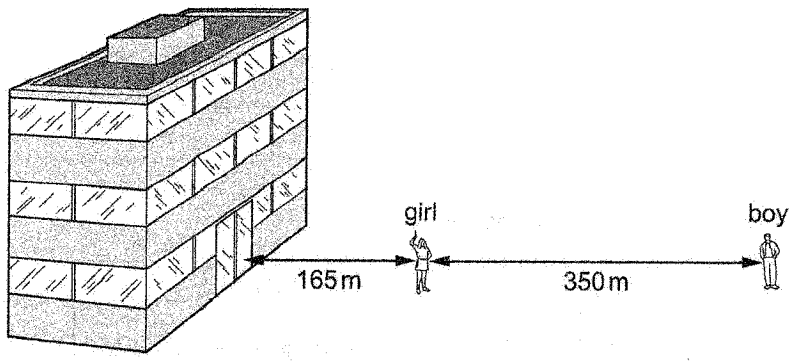
gamma rays	P	Q	visible light	infrared	R	radiowaves

What are the components P, Q and R?

	P	Q	R
A	microwaves	ultraviolet	X-rays
B	ultraviolet	X-rays	microwaves
C	X-rays	microwaves	ultraviolet
D	X-rays	ultraviolet	microwaves

14 A girl, standing 165 m in front of a tall building, fires a starting pistol.

A boy, standing 350 m from the girl, hears two bangs 1.0 s apart.



Using this information, what is the speed of sound in air?

A 330 m/s **B** 350 m/s **C** 515 m/s **D** 680 m/s

15 There is a potential difference (p.d.) across a component in an electric circuit.

In time t, charge Q is driven through the component. The work done, in driving Q through the component in this time, is W.

What is the p.d. across the component?

A QWt **B** $\frac{QW}{t}$ **C** $\frac{Q}{W}$ **D** $\frac{W}{Q}$

7 A table has four legs. The area of the base of each leg is 5.0 cm^2.

The pressure exerted on the floor by the table is 50 kPa.

The gravitational field strength is 10 N/kg.

What is the mass of the table?

A 2.5 kg **B** 10 kg **C** 25 kg **D** 100 kg

8 A stationary object is dropped from the top of a tower.

Just before impact with the ground its speed is 20 m/s.

The gravitational field strength is 10 N/kg.

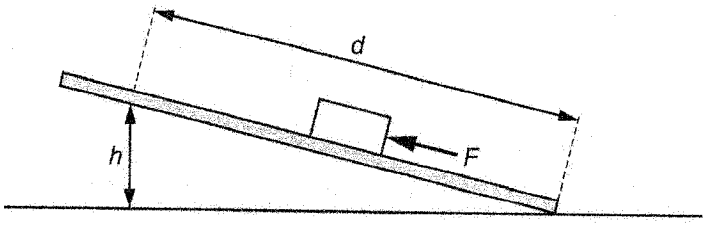
Frictional forces are negligible.

What is the height of the tower?

A 20 m **B** 40 m **C** 100 m **D** 200 m

9 A force *F* pushes a box at a constant speed a distance *d* along a rough inclined surface.

The box rises a vertical height *h*.



The mass of the box is *m*. The gravitational field strength is *g*.

Which equation is used to calculate the work done *W* by the force *F*?

A $W = Fd$

B $W = Fd + mgh$

C $W = Fd - mgh$

D $W = mgh$

1 Which two quantities are both scalars?

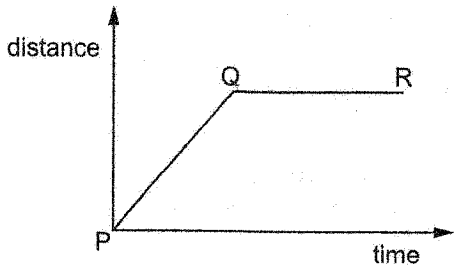
A acceleration and weight

B acceleration and mass

C length and mass

D length and weight

2 The motion of an object moving in a straight line is shown by a distance–time graph.



Which row describes the motion of the object from P to Q and from Q to R?

	P to Q	Q to R
A	moving with increasing acceleration	not moving
B	moving with increasing speed	moving with uniform speed
C	moving with uniform acceleration	moving with uniform speed
D	moving with uniform speed	not moving

3 Which statement about friction is **not** correct?

A Friction in air is also called air resistance.

B Frictional forces only decrease the velocity of an object.

C Frictional forces can cause energy to be wasted as thermal energy.

D Friction is different between different pairs of surfaces.