TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR
PHYSICS

CANDIDATE NAME

CLASS

INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

25 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, index number on the Answer Sheet.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**.
Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** printed pages.

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1 A list of 8 physical quantities is shown below:

length	time	energy	force
speed	weight	mass	acceleration

How many of them are derived quantities?

A 3 **B** 4 **C** 5 **D** 6

2 Which sound frequency is within the range that can be heard by a healthy human ear?

A 12 mHz **B** 12 Hz **C** 12 kHz **D** 12 MHz

3 Which pair of physical quantities contains a vector and a scalar quantity?

A area and displacement

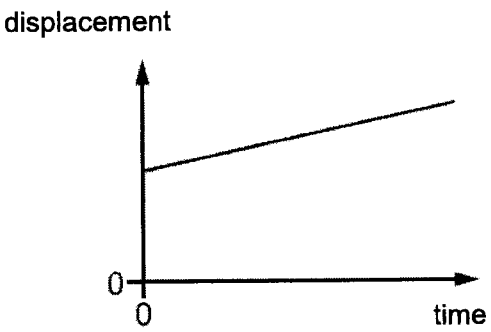
B distance and volume

C temperature and pressure

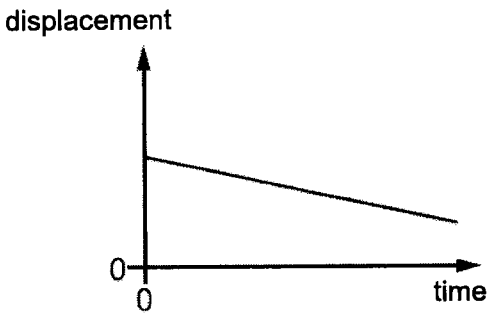
D weight and velocity

4 Which displacement-time graph represents a body whose velocity is decreasing?

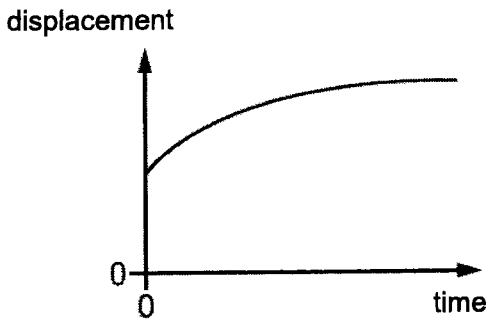
A



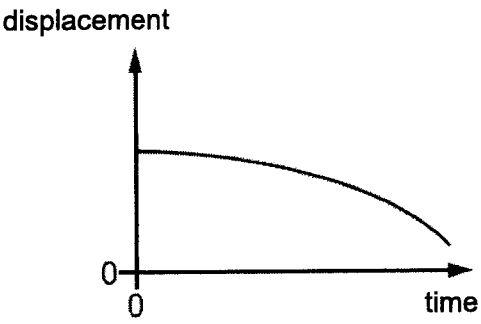
B



C

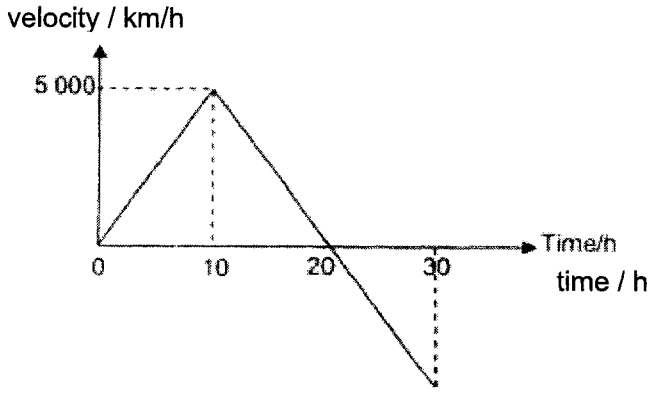


D



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5 A spacecraft is launched vertically. The velocity-time graph of the motion of the spacecraft is shown in the diagram.



What is the maximum height reached by the spacecraft?

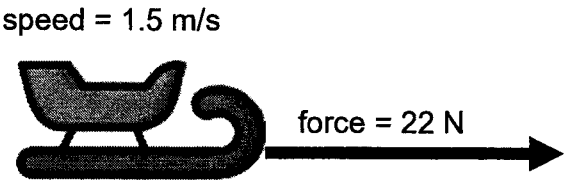
A 25 000 km

B 50 000 km

C 75 000 km

D 100 000 km

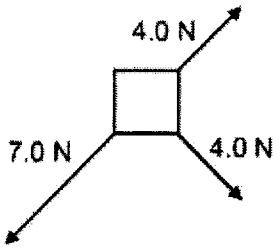
6 A sledge of mass 12 kg is pulled along the surface of a frozen lake at a constant speed of 1.5 m/s by a horizontal force of 22 N.



What is the frictional force acting on the sledge?

A 0 N **B** 4 N **C** 18 N **D** 22 N

7 The diagram shows multiple forces acting on a square object along the diagonal.

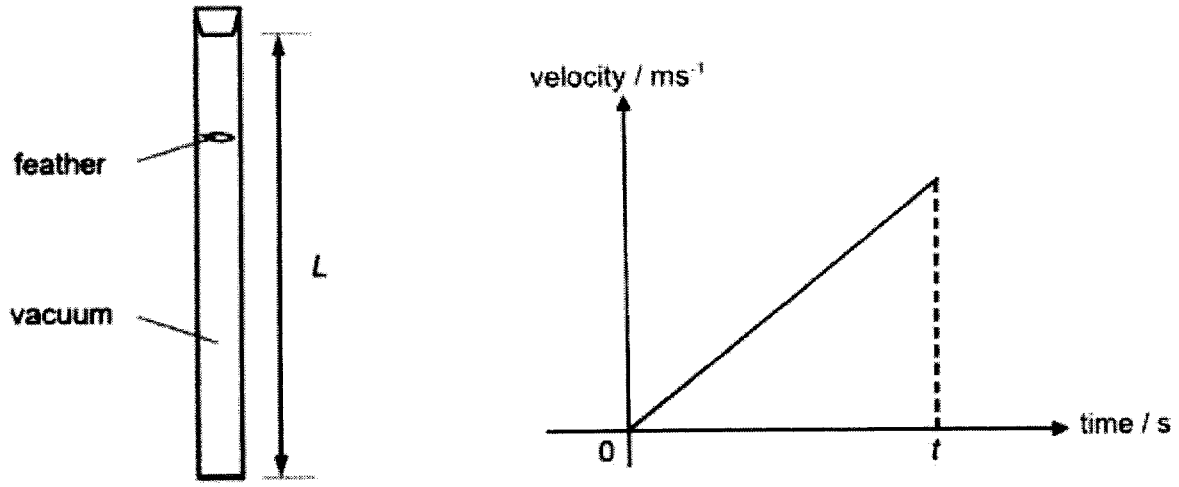


What is the possible magnitude of the resultant force acting on the object?

A 1.0 N **B** 3.0 N **C** 5.0 N **D** 11.0 N

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8 In a laboratory experiment, a feather falls from rest in an evacuated vertical tube of length *L*. The feather took a time of *t* to fall from the top to the bottom of the tube.

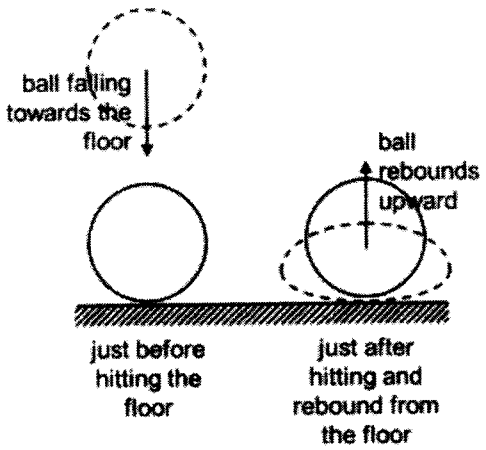


The diagram shows the experiment setup and the velocity-time graph of the feather as it falls.

How far will the feather have fallen from the top of the tube in 0.5*t* ?

A 0.13 L **B** 0.25 L **C** 0.50 L **D** 0.75 L

9 A ball is dropped downwards, hits the floor and rebounds upward. The figure below shows the instance of the ball just before and right after it hits the floor.



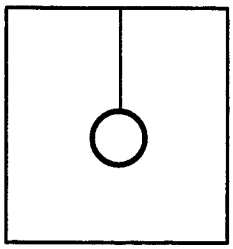
Which row shows the correct description of the acceleration just before and after the ball hits the floor?

	just before hitting the floor	**just after hitting the floor**
A	acceleration is 10 m/s^2 downwards	acceleration is 10 m/s^2 upwards
B	acceleration is 0 m/s^2 downwards	acceleration is 0 m/s^2 upwards
C	acceleration is 0 m/s^2 downwards	acceleration is 0 m/s^2 downwards
D	acceleration is 10 m/s^2 downwards	acceleration is 10 m/s^2 downwards

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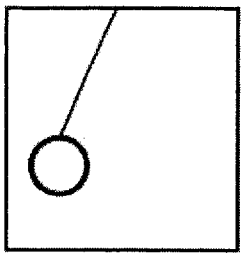
10 Ahmad hung a ball to the ceiling of his car using a thin thread.

The figure shows the ball when the car is at rest.

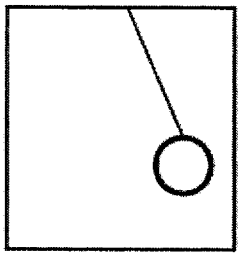


What is the position of the ball when his car starts moving to the right?

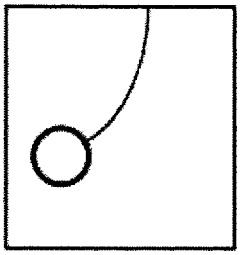
A



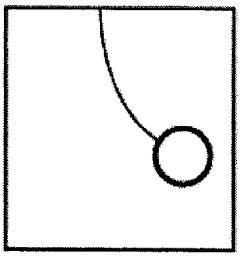
B



C

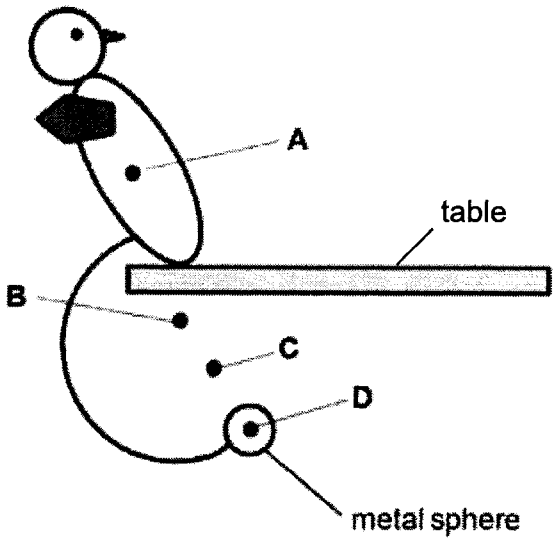


D



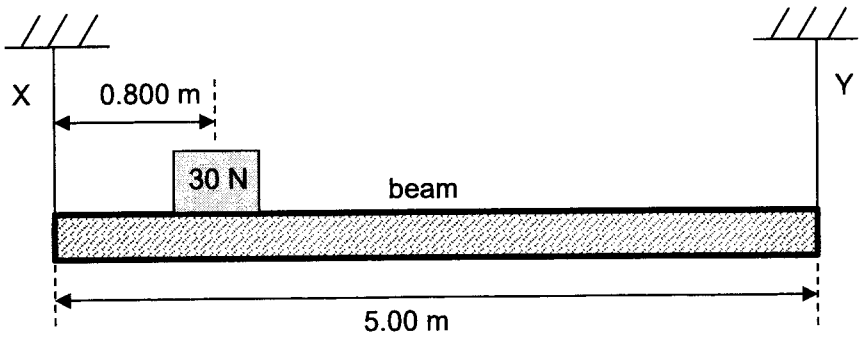
11 A toy is balanced and at rest when positioned as shown in the diagram on the edge of a table. The toy has a metal sphere attached to it.

Where is the likely centre of gravity of the toy?



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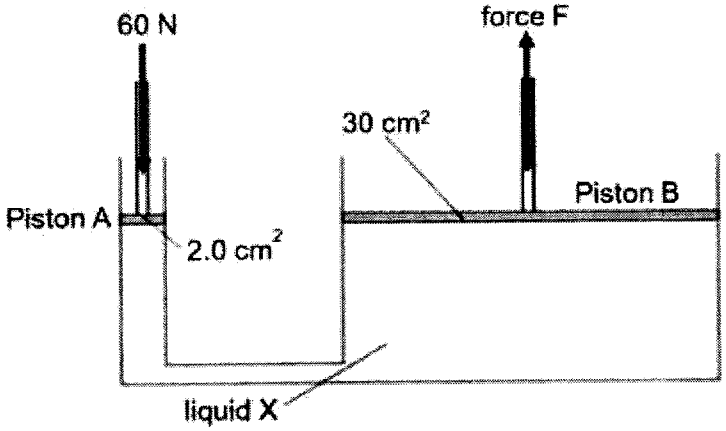
12 A uniform beam of 5.00 m has a weight of 140 N, is hung by two ropes at its ends. A wooden block of mass of 30.0 N is placed on the beam at 0.800 m from rope X.



What is the tension in each rope?

	tension in rope X/ N	tension in rope Y/ N
A	4.8	25.2
B	25.2	4.8
C	74.8	95.2
D	95.2	74.8

13 A hydraulic press contains an incompressible liquid X. Piston A has an area of 2.0 cm^2 and piston B has an area of 30 cm^2.



A downward force of 60 N is exerted on piston A and moves piston A downwards through a distance of 15.0 cm.

What is the upward force F exerted on piston B and the distance d moved by piston B?

	force F / N	distance d / cm
A	900	1.0
B	900	0.50
C	1800	1.0
D	1800	0.50

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14 The pressure inside a gas cylinder is measured separately using two different mercury manometers as shown in Fig. **P** and **Q**. One of the manometers has an open end while the other has a sealed end.

A barometer, as shown in Fig. **R**, is used to measure the atmospheric pressure at the location of the experiment.

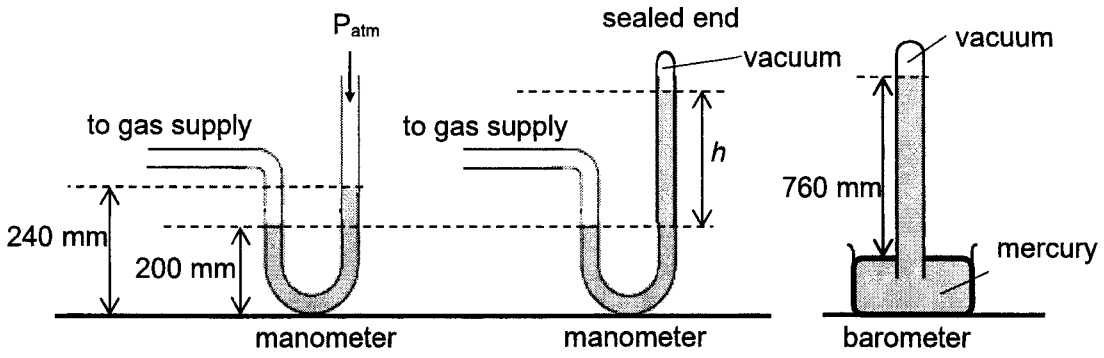


Fig. **P** Fig. **Q** Fig. **R**

The diagrams are not drawn to scale.

What is the height, *h*, of the mercury in Fig. **Q**?

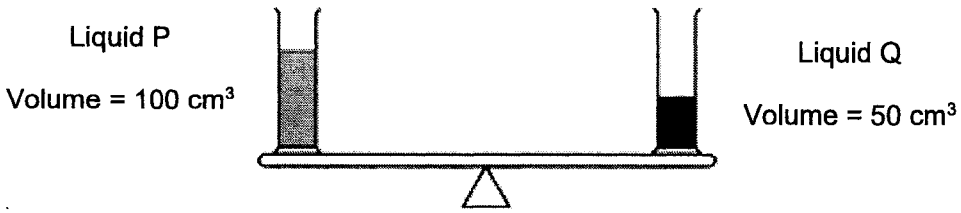
A 40 mm

B 720 mm

C 800 mm

D 1000 mm

15 Two identical measuring cylinders containing different liquids are placed on a simple balance. They are balanced as shown.



How does the density of P compare with the density of Q?

A Density of P is half the density of Q.

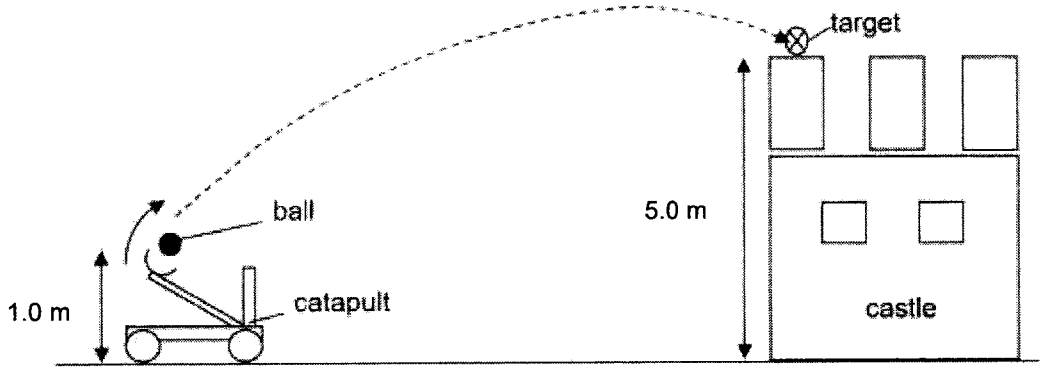
B Density of P is equal to the density of Q.

C Density of P is twice the density of Q.

D Density of P is four times the density of Q.

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16 A catapult launches a 3.0 kg ball into a castle. The ball leaves the catapult at a height of 1.0 m and with a speed of 15 m/s. A target is placed 5.0 m at the top of the castle.

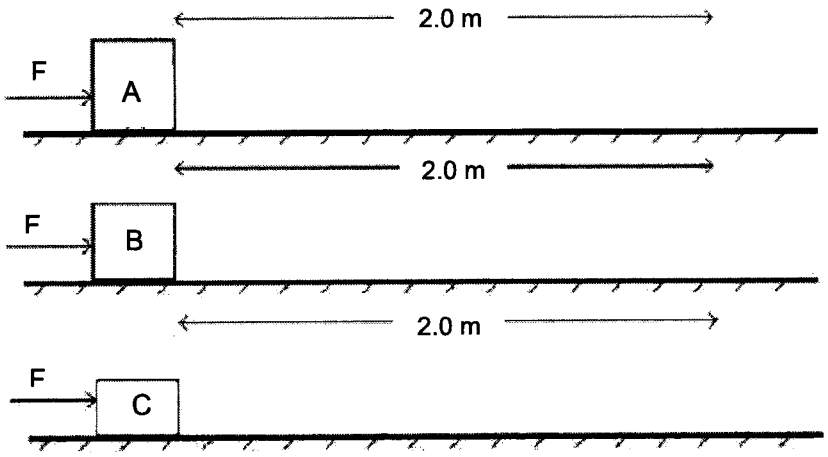


What is the speed of the ball when it hits the target? Assume there is no air resistance.

A 9.80 m/s **B** 11.1 m/s

C 12.0 m/s **D** 13.0 m/s

17 Three blocks A, B, and C are each pushed by equal forces, F, across a smooth horizontal floor for a distance of 2.0 m.



The mass of block A is greater than block B, and the mass of block B is greater than block C.

Which block/s would have the greatest amount of energy in the kinetic store at the end of the 2.0 m push?

A Block A

B Block B

C Block C

D All blocks will have the same amount of energy in the kinetic store

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18 A cup of coffee is warmed from 20 °C to 30 °C. Which energy store of the coffee rises?

A Its nuclear store

B Its internal store

C Its chemical potential store

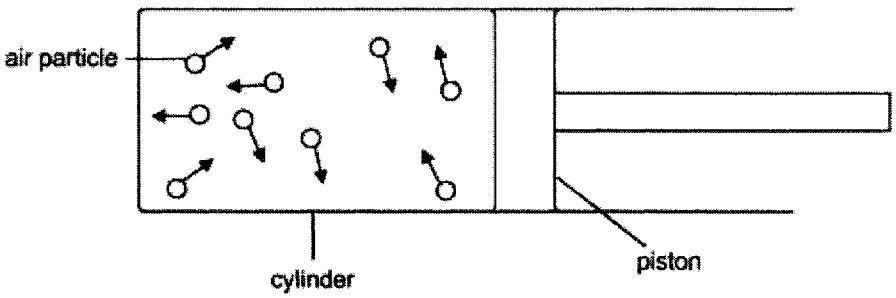
D Its kinetic store

19 Electrical power of 3000 W is supplied to a motor to lift a weight of 100 N at a speed of 20 m/s for 5.0 s.

What is the efficiency of the motor?

A 0.07 **B** 0.33 **C** 0.67 **D** 1.30

20 Which statement describes what happens when a gas in a piston is compressed at constant temperature?



A The number of gas molecules per unit volume decreases.

B The rate of collisions between the gas molecules and the piston wall increases.

C The speed of gas molecules increases.

D The volume of each gas molecule decreases.

21 Brownian motion can be observed by the behaviour of smoke particles in a smoke cell.

What does Brownian Motion show?

A Air is a poor conductor.

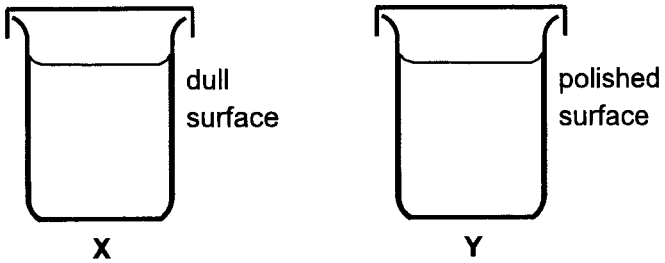
B Air molecules are moving.

C Air molecules have more mass than smoke particles.

D Convection occurs in air.

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22 In the diagram, two copper cans **X** and **Y** with outer surface of different texture are filled with the same amount of water at boiling point and left in the room.



Which of the following statements about the temperature of the two cans after a short while is true?

A **X** is cooler because a dull surface is a good absorber.

B **X** is cooler because a dull surface is a good emitter.

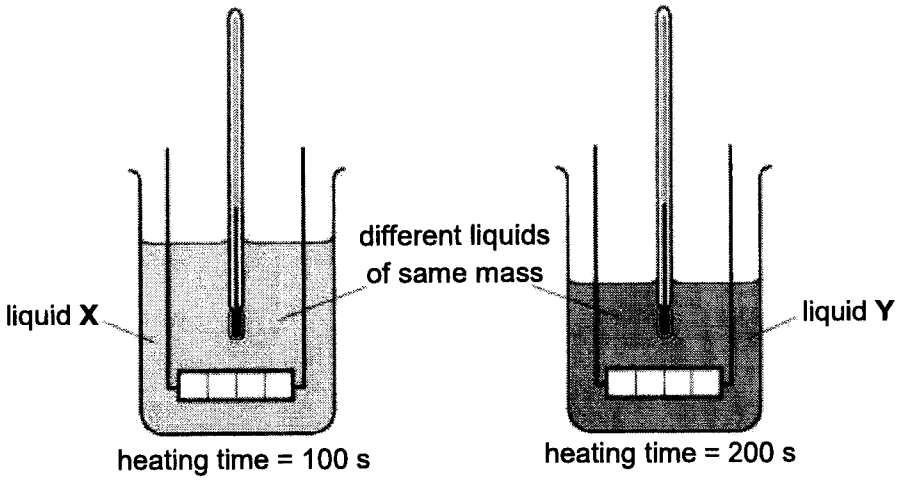
C **X** is warmer because a dull surface is a good absorber.

D **X** is warmer because a dull surface is a good emitter.

23 Equal masses of two different liquids are put into identical beakers.

Liquid **X** is heated for 100 s and liquid **Y** is heated for 200 s by heaters of the **same power**.

Each liquid has the same rise in temperature.



Which of the following statements is correct?

A Each beaker of liquid has the same heat capacity.

B Each beaker of liquid receives the same energy.

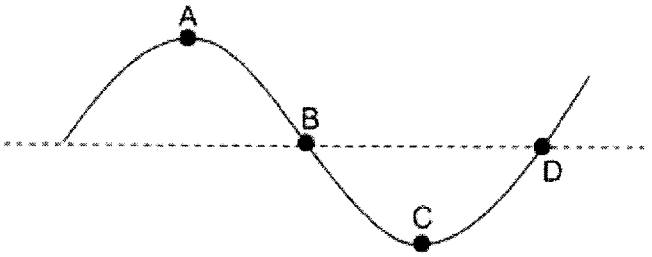
C Liquid **X** receives more energy than liquid **Y**.

D The heat capacity of liquid **X** is less than the heat capacity of liquid **Y**.

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24 The diagram below shows the position of a string at a particular instant of time as a transverse wave travels along it from left to right.

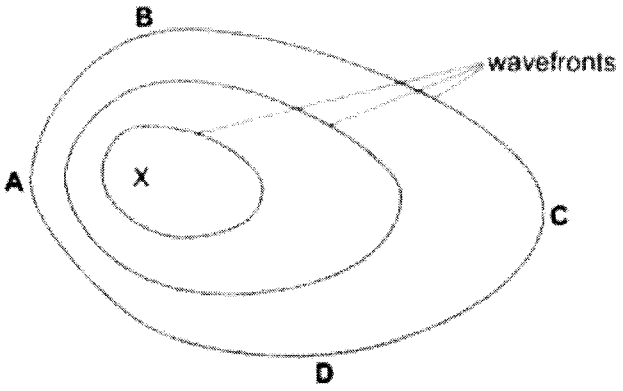
Which point represents the particle on the string that is moving downwards and with highest speed?



25 Waves travel more quickly on the surface of water when the water is deep.

A stone is dropped at point X into a pool of varying depth. The diagram shows the first three wavefronts on the surface of the pool.

The region between X and which labelled point is likely to be the deepest?



26 Visible light, X-ray and microwaves are all components of the electromagnetic spectrum.

Which of the following statements about the waves is correct?

A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.

B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.

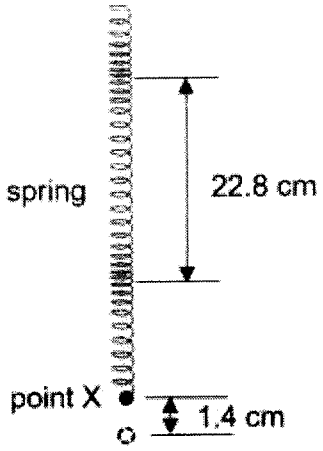
C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.

D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

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27 The diagram shows a spring oscillating vertically.

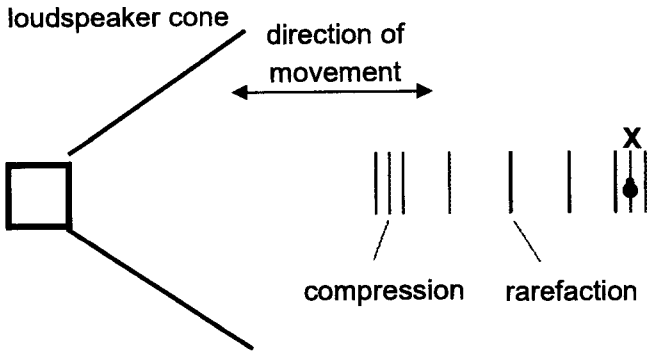
Point X at the end of the spring is oscillating between two vertical points 1.4 cm apart.



Which row describes the wave?

	amplitude / cm	wavelength / cm
A	0.7	11.4
B	0.7	22.8
C	1.4	11.4
D	1.4	22.8

28 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forward. The frequency of vibration is 50 Hz.



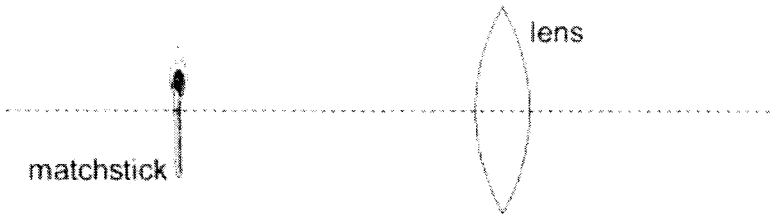
A compression is at point **X**.

How much time elapses before the first rarefaction arrives at **X**?

A 0.010 s
B 0.020 s
C 25 s
D 50 s

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29 A lighted matchstick is placed 20 cm from a converging lens with a focal length of 10 cm.

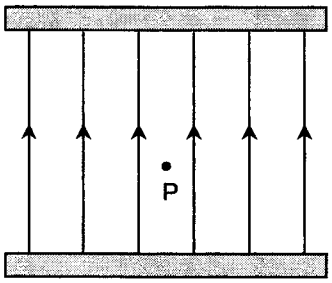


How much should the matchstick move in order to form a parallel beam of light on the other side of the lens?

A 5 cm to the right
B 5 cm to the left
C 10 cm to the right
D 15 cm to the right

30 The figure shows a uniform electric field between two metal plates.

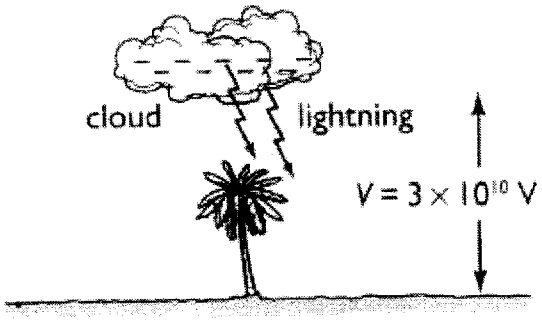
Describe the movement of the electron at P.



A downwards
B to the left
C to the right
D upwards

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31 During a thunderstorm, a lightning sent an electric charge of 90 C from a thundercloud to the earth. The potential difference between the thundercloud and the earth was 3 x 10^{10} V during the discharge.



How much energy was produced during the lightning?

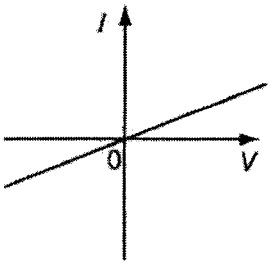
A 2.7 x 10^{10} J

B 2.7 x 10^{12} J

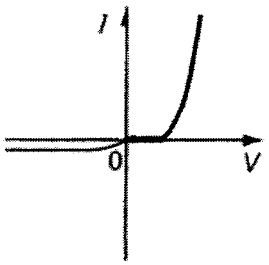
C 3.0 x 10^{12} J

D 1.3 x 10^{13} J

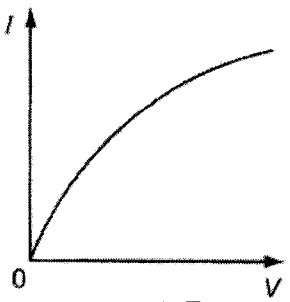
32 The three graphs X, Y and Z show the I-V characteristics for three different components.



graph X



graph Y



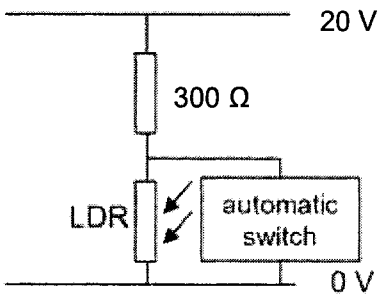
graph Z

Which components do each of the graphs represent?

	graph X	graph Y	graph Z
A	diode	filament lamp	metallic conductor
B	filament lamp	diode	metallic conductor
C	metallic conductor	diode	filament lamp
D	metallic conductor	filament lamp	diode

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33 The circuit shown below is connected to an automatic switch for a streetlight. The automatic switch needs a voltage of 12 V or higher for the lights to be on. The lights are to turn on at sunset and the value of the fixed resistor is 300 Ω.



What must the minimum resistance of the light-dependent resistor be in order for lights to turn on at sunset?

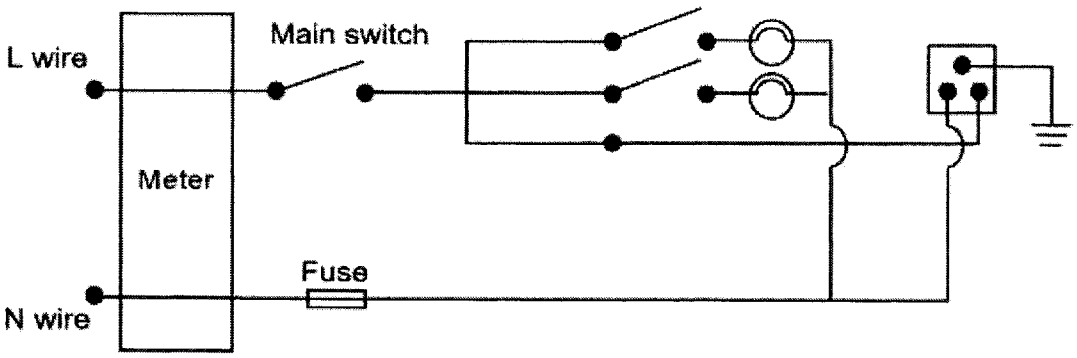
A 120 Ω

B 200 Ω

C 450 Ω

D 600 Ω

34 What is the mistake in the household circuit shown below?



A The position of the earth wire in the socket is wrong.

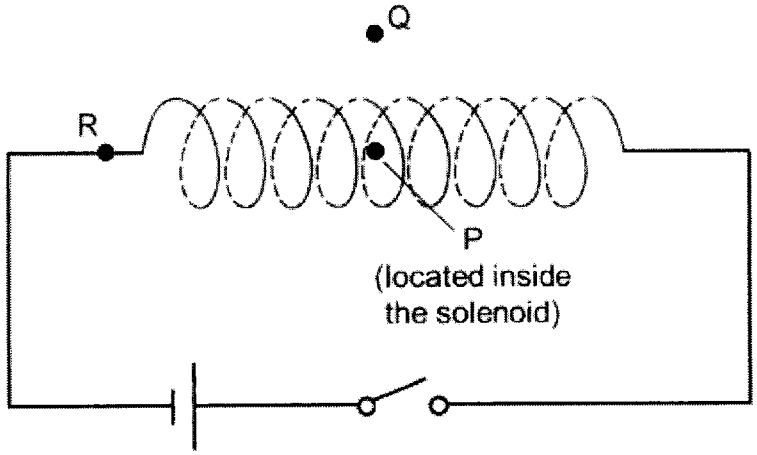
B There should be an earth wire connected to the bulbs.

C The fuse should be installed at the live wire.

D The neutral and the live wire in the socket should be interchanged.

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35 A solenoid is connected to a DC supply and three compasses, P, Q and R, are placed around the solenoid as shown below.



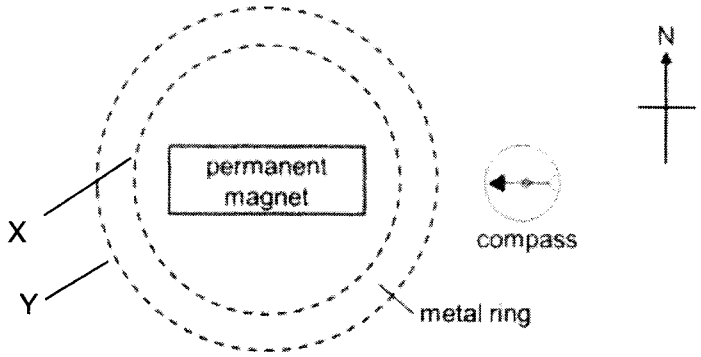
When the switch is closed, which row shows the direction in which the compass needles point to?

	P	Q	R
A	→	←	→
B	←	→	←
C	←	←	→
D	→	→	←

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36 A magnet and a compass is placed next to each other as shown. Under the influence of the magnet, the compass pointer is deflected from the North direction.

Two different metal rings (X and Y) are then placed around the magnet, occupying the dotted area.

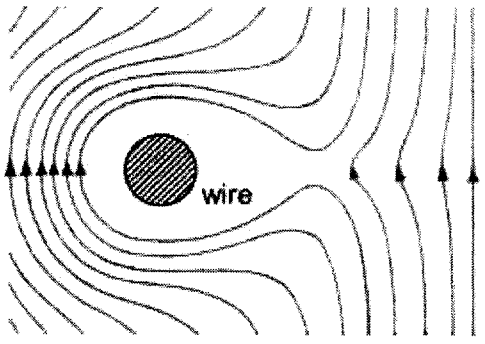


When metal ring X is placed first around the magnet, the compass pointer continues to point left. However, when metal ring Y is placed around the magnet, the compass pointer returns to the North direction.

What are rings X and Y made of?

	ring X	**ring Y**
A	aluminium	copper
B	copper	iron
C	iron	aluminium
D	iron	steel

37 The diagram below shows the resultant field pattern around the cross-section of a direct-current carrying straight wire placed in a uniform magnetic field.



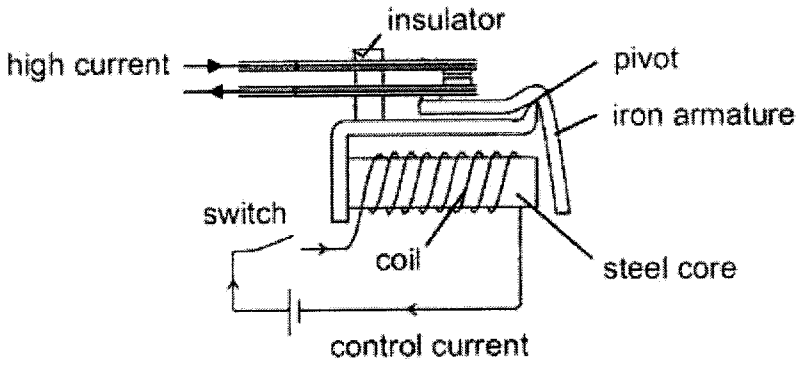
What is the direction of the current flowing through the wire?

A left **B** right

C out of the paper **D** into the paper

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38 The diagram shows a magnetic relay.



When the switch is turned on, the electromagnet is unable to attract the iron armature to allow the high current to flow in the circuit.

Which change will resolve this problem?

A moving the armature further from the steel core

B reducing the number of turns of coil around the steel core

C replacing the steel core by an iron core

D using a smaller control current

39 A power station produces 150 MW of power. It uses a transformer to step-up the transmission voltage to 250 kV. The transmission cable has a resistance of 15 Ω.

What is the ratio of power loss in the transmission cable to the power produced?

A 0.00036 **B** 0.0036 **C** 0.036 **D** 0.36

40 In an experiment to determine the half-life of a radioactive isotope, the following results were obtained.

activity/counts per second	60	44	29	21	15	11
time/s	0	1	2	3	4	5

What is the approximate half-life of the isotope?

A 1.0 s **B** 2.0 s **C** 3.0 s **D** 4.0 s

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Section A

2025 Phy P2

Answer **all** questions in this section.

1 Fig 1.1 shows an arrow about to be released. When the bowstrings are stretched to the extent shown in Fig. 1.1, the tension in each of the bowstrings is 80 N, while the angle between the bowstring and arrow is 45°.

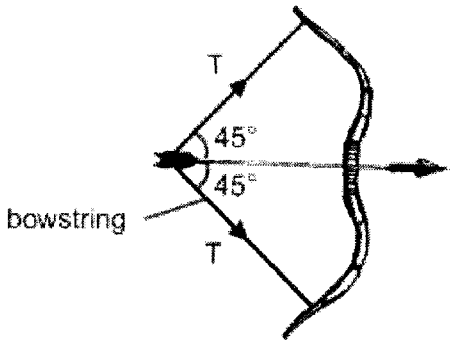


Fig 1.1

Draw a scaled vector diagram to determine the magnitude of the resultant force acting on the arrow due to the bowstrings just before it is released.

scale = ...

magnitude of resultant force = ...[4]

[Total: 4]

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2 Fig. 2.1 shows a child sliding down a slope on a snow sledge.

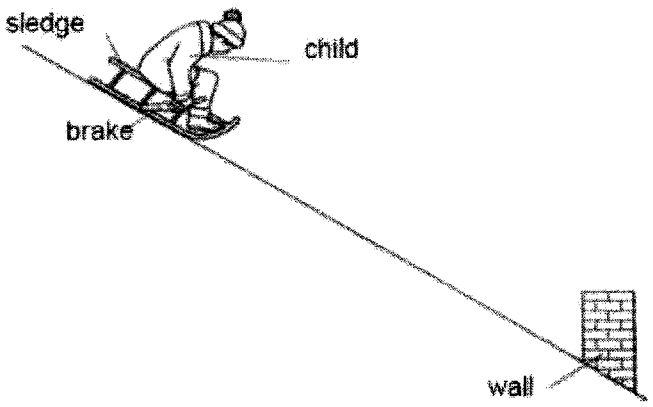


Fig 2.1

At time t = 0, the child and the sledge begin to move down the hill. When the child sees a wall ahead, he applies the brake and eventually comes to a stop.

Fig. 2.2 shows the velocity time graph of the journey.

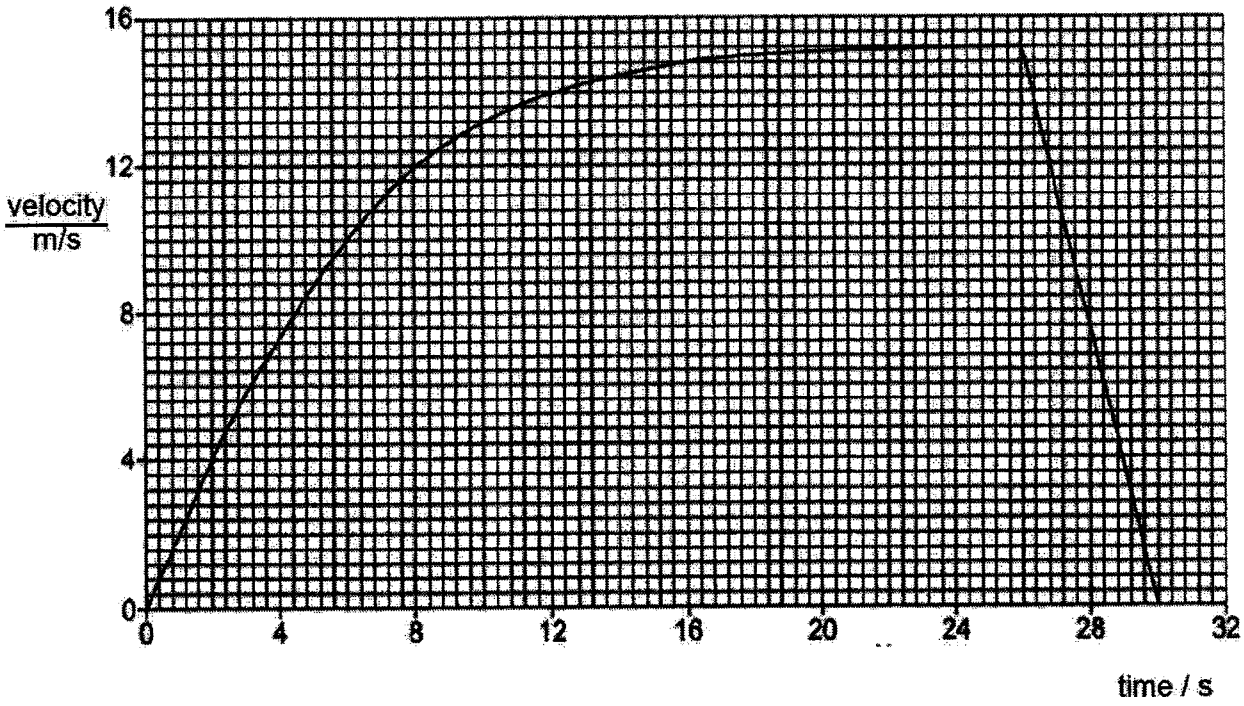


Fig 2.2

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(a) Explain, using ideas of forces, why the speed varies in the way shown in Fig 2.2 between t = 0 s and t = 26 s.

.....

.....

.....

.....

.....

.....[3]

(b) Explain how the graph shows that the child and the sledge reach terminal velocity.

.....

.....[1]

(c) At t = 26 s, the front of the sledge is 35 m away from the wall.

Determine if the child is able to come to a stop before hitting the wall.

.....

.....[2]

(d) State the main energy changes during time t = 24 s to t = 26 s.

.....

.....[1]

(e) At t = 26 s, when the brakes are first applied, the child jerks forward on the sledge. Explain why this happens.

.....

.....[1]

[Total: 8]

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3 Fig 3.1 shows a crane with a boom angle of 30° used on construction sites to lift heavy loads. The length of the crane boom is 45.0 m and the perpendicular distance of the load to the pivot X is 22.0 m.

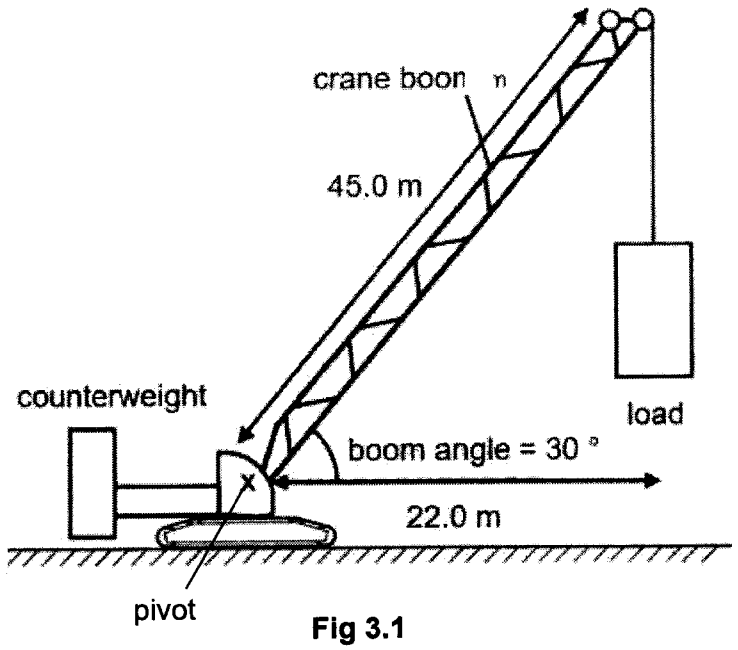


Fig 3.1

Table 3.1 shows the maximum load the crane can support at different boom angles.

Table 3.1

boom angle / °	maximum load / N
30	11 500
45	14 000
60	20 000

(a) Explain why the maximum load increases as the boom angle increases.

.....

.....

.....

.....[2]

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(b) **(i)** Calculate the maximum moment that the crane can support when the boom angle is 30°.

maximum moment = ...[2]

(ii) Given that the counterweight is 5.0 m away from pivot X when the boom angle is 30°, calculate the weight of the counterweight.

weight = ...[2]

Total: [6]

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4 Fig. 4.1 shows a U-tube which contains mercury being used as a manometer to measure the pressure from a gas supply in a container. One end of the tube is connected to the gas supply and the other end is open.

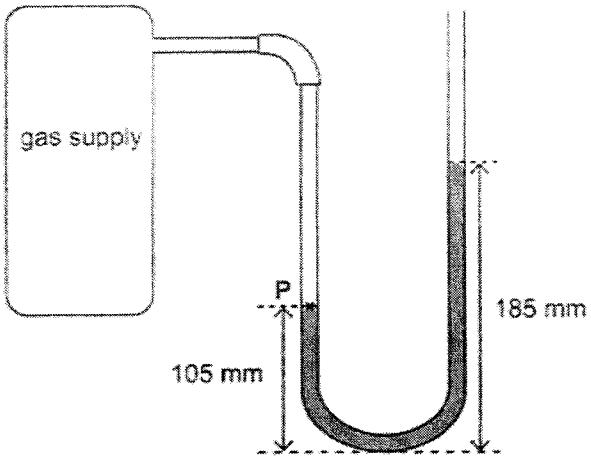


Fig. 4.1

(a) Describe how gas molecules create a pressure with the gas supply.

.....

.....[1]

(b) Explain why the mercury level moves down on the left side of the U-tube when the gas supply is connected.

.....

.....[1]

(c) Given that the density of mercury is 13 600 kg/m^3 and the atmospheric pressure is 760 mm Hg, calculate the pressure of the gas supply in pascal.

pressure = ... [2]

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(d) The gas supply is made to cool down to a lower temperature. Describe and explain the effect on the difference in the mercury levels between the left and right side of the U-tube.

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

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5 In a company that manufactures frying pans, a researcher wishes to select a new material that can be used for the base of the pan. Table. 5.1 shows four possible materials and their properties.

Table 5.1

material	melting point / °C	specific heat capacity / J/(kg °C)
A	2350	900
B	950	480
C	1600	480
D	7800	130

(a) The researcher carries out a series of experiments on the materials.

(i) In one of the experiments, a 2.0 kg sample of material A is heated by an electrical heater of power 450 W. The initial temperature of the sample is 25 °C.

Calculate the time taken for the temperature of the sample to rise to 100 °C.

time taken = ...[2]

(ii) Using the data in Table 5.1, discuss which material is the most suitable to be used for the base of the frying pan. Give one reason to support your choice.

.....

.....

.....

.....[2]

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(b) 2.3 kg of hot water at boiling point is poured into the frying pan. 5 190 000 J was supplied to convert all the water into steam. Calculate the specific latent heat of vaporisation of water.

specific latent heat of vaporisation= .....[2]

[Total: 6]

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6 A water wave is travelling from left to right across the water surface of a pond at a speed of 24 cm/s.

Fig 6.1 shows a snapshot of the wave at a certain instant. **R** and **S** are two water particles on the water surface. **R** makes 45 complete oscillations in one minute.

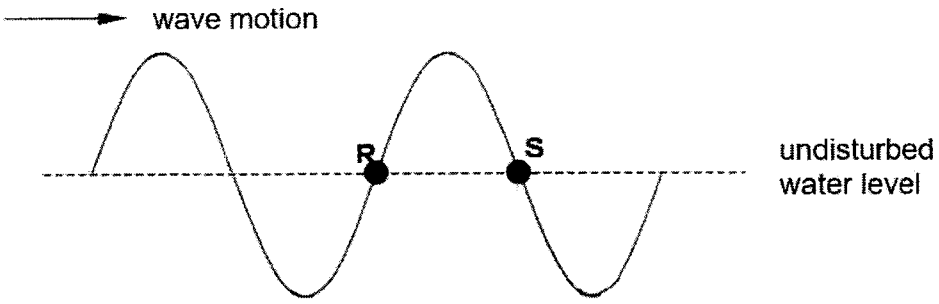


Fig 6.1

(a) State the type of wave generated. Explain your answer.

.....

.....

.....

.....[2]

(b) Calculate

(i) the time taken for **R** to reach the highest point,

time taken = ... [2]

(ii) the distance between **R** and **S**.

distance = ... [2]

[Total: 6]

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7 Fig. 7.1 shows a method of producing sandpaper using static electricity.

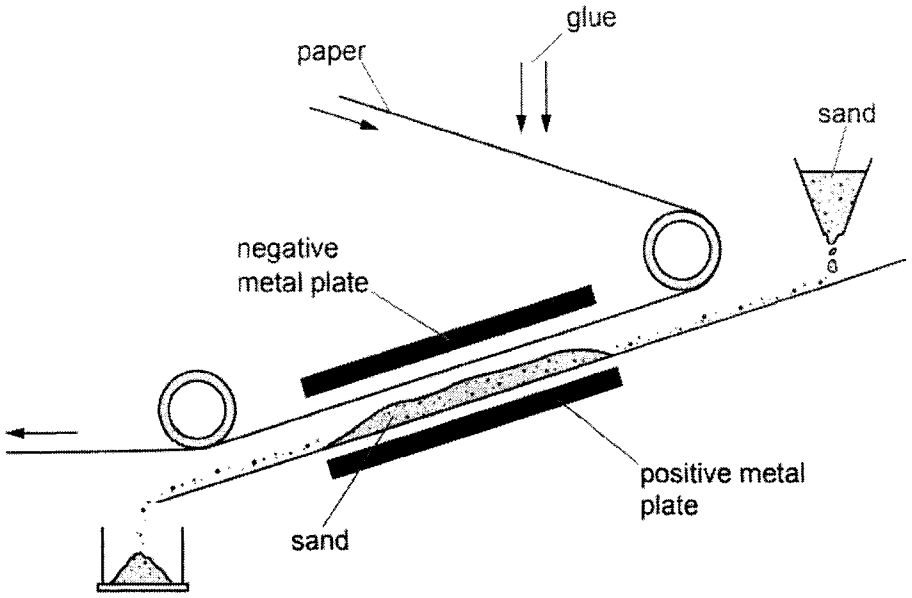


Fig. 7.1

Glue is sprayed onto moving paper. The sticky paper will then pass between two metal plates. One of the plates is positively charged and the other plate is negatively charged. There is an electric field between the plates.

(a) On Fig. 7.2, draw and show the direction of the electric field between the two metal plates. [2]

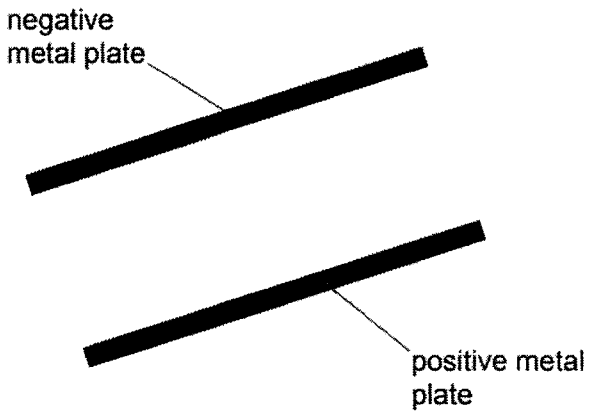


Fig. 7.2

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(b) Grains of sand are present just below the sticky paper. Each grain of sand is given a charge. Fig. 7.3 shows two layers of sand grains in the space between the two plates.

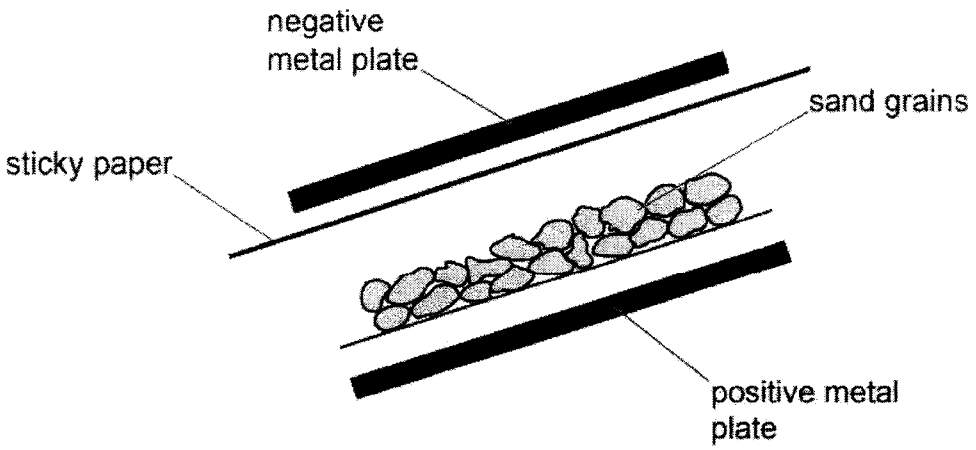


Fig 7.3

Sand grains are attracted to the negative metal plate.

State and explain whether the sand grains are positively or negatively charged.

.....

.....

.....

.....[2]

(c) A man accidentally touches the exposed part of the positive plate. The potential difference between the hand and the metal is 1500 V and the charge transferred is 4.0×10^{-4} C.

Calculate the energy transferred when the charges pass through him.

energy = ... [2]

[Total: 6]

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8 Fig. 8.1 shows two types of filament lamps A and B, one with its filament wire coiled and the other with its filament wire uncoiled.

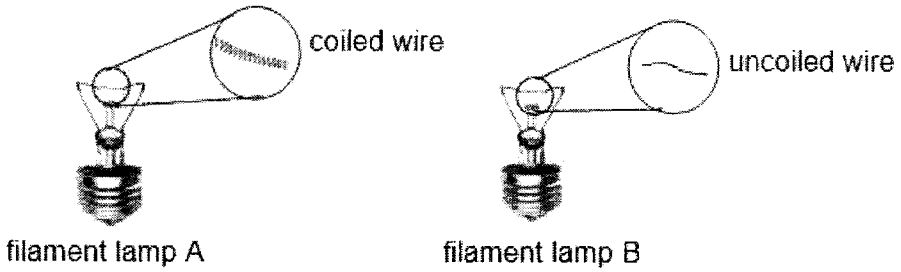


Fig. 8.1

Table 8.1 summarises the design and characteristics of the two filament lamps A and B.

Table 8.1

lamp	characteristics of filament wire		
	material	coiled / uncoiled	resistivity / Ω m
A	tungsten	coiled	5.38
B	copper	uncoiled	1.72

(a) Lamp A is observed to be brighter. Using information from Table 8.1, explain why this is so.

.....

.....

.....

.....[2]

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(b) Lamps A and B are non-ohmic. Their resistances change with temperature due to heating.

When connected in series, the total resistance of the lamps is observed to be lower than when they are connected in parallel.

The brightness of the lamps also differs between the two circuits.

Using the relationship between power dissipation, current, and temperature, explain why the resistances of the lamps decrease in the series arrangement.

.....

.....

.....

.....

.....

.....

.....

.....

.....[3]

(c) The fuse is wrongly connected to the earth wire of the circuit. Describe what happens to the fuse, lamp and user when the live wire touches the metal surface of the filament lamp.

.....

.....

.....

.....[2]

[Total: 7]

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9 Fig. 9.1 shows a wind turbine. When the turbine turns, part of the energy in the kinetic store of the wind is transferred mechanically to the kinetic store of the motor blades of the turbine.

The blades of the turbine are 10 m long. On average, 18 000 kg of air, moving at a speed of 12 m/s, hit the blades every second.

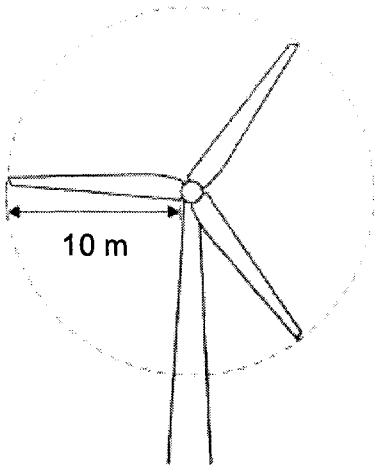


Fig 9.1

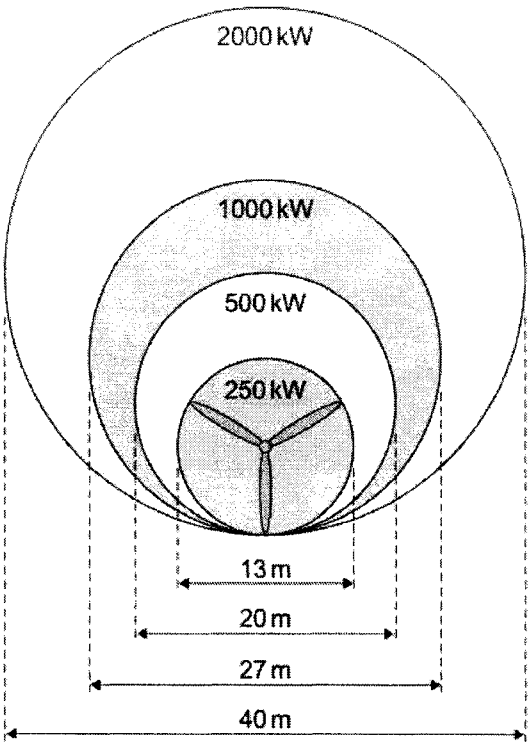


Fig 9.2

Fig. 9.2 shows that, for the same wind speed, the power output of a turbine depends on the length of the turbine blades.

(a) Calculate the energy in the kinetic store of the air hitting the blades shown in Fig. 9.1 in each second.

energy in the kinetic store = ... [2]

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(b) Calculate the efficiency of the turbine with 10 metres long blades.

efficiency = ...[1]

(c) Using the information given, show that doubling the diameter of the blades, more than doubles the power output of a turbine.

.....

.....

.....

.....[2]

(d) State a disadvantage of using wind turbines to produce electrical power.

.....

.....[1]

(e) The wind turbine is connected to a generator as shown in Fig. 9.3. The turbine causes the coils in the generator to rotate.

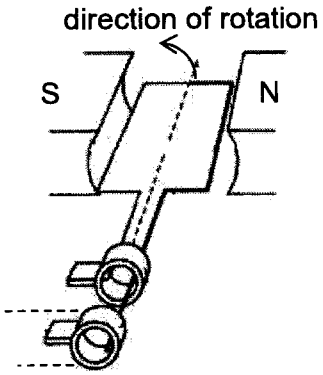


Fig. 9.3

Explain why an e.m.f is induced in the coil when it rotates between the magnets.

.....

.....[1]

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(f) The set-up in Fig. 9.4 shows another way in which an e.m.f. is induced in a coil. Fig. 9.5 shows the result after the magnet is released from a height.

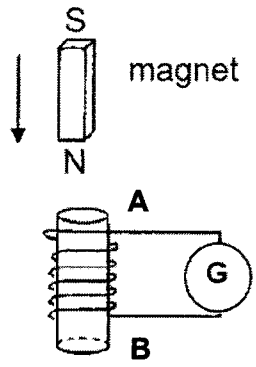


Fig. 9.4

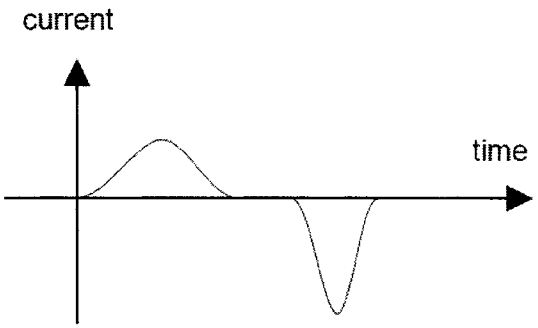


Fig 9.5

(i) State the polarity induced at end **A** of the solenoid when the magnet enters the coil.

.....

.....[1]

(ii) Explain why the magnitude of the 'negative peak' is greater than that of the 'positive peak'.

.....

.....

.....

.....[2]

[Total: 10]

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10 A liquid containing some radioactive material is injected into the patient's blood stream. This radioactive material would be absorbed by the kidneys and then passed to the patient's bladder. A special camera is used to detect the radiation coming from the patient's kidneys.

Before the radioactive liquid is injected, background radiation must be measured to ensure accurate detection of radiation from the patient's body.

The half-life of four gamma sources W, X, Y and Z are listed in the Table 10.1.

Table 10.1

Radioactive Source	Half- life
W	2 min
X	5 min
Y	4 hours
Z	8 days

(a) Describe how background radiation can be measured.

.....

.....[1]

(b) The initial count rate of Y is 8000 counts per minute.

What is the count rate of Y after 24 hours?

activity = ...counts per min [2]

(c) Radioactive materials that emit alpha particles are never injected into the body to obtain medical images of parts of the body.

State two reasons why alpha emitting materials are unsuitable.

.....

.....

.....

.....[2]

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(d) The examination of the patient lasts for 15 minutes.

State and explain which radioactive source would be most suitable for the examination.

.....

.....

.....

.....[2]

(e) Protactinium-234 ($^{234}_{91}Pa$) is a radioactive isotope of protactinium that decays to uranium-234 ($^{234}_{92}U$).

Complete the equation below for this radioactive decay: [1]

$$^{234}_{91}Pa \rightarrow {}^{234}_{92}U + \text{.....}$$

(f) State two different safety precautions the doctor must follow when handling the radioactive sources.

.....

.....

.....

.....[2]

[Total: 10]

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Section B

Answer **one** question from this section.
Answer either **Question 11** or **Question 12**.

11 **(a)** Fig. 11.1 shows a regular hexagonal glass piece of refractive index 1.42. A light ray enters the glass piece at P, at a direction parallel to its top surface.

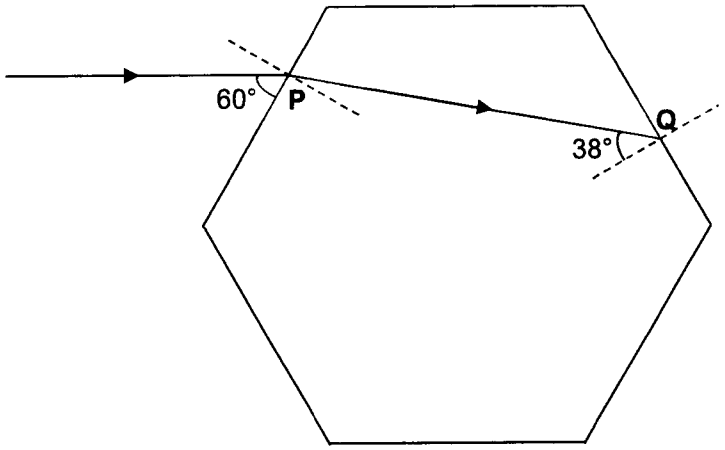


Fig. 11.1 (not drawn to scale)

(i) Determine the angle of refraction of the light ray at **P**.

angle of refraction = ... [2]

(ii) State what is meant by *critical angle*.

.....

.....[1]

(iii) Determine the critical angle of the hexagonal glass piece.

critical angle = ... [2]

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(iv) On Fig. 11.1, complete the path of the light ray after it strikes the surface at **Q.** [1]

(b) Fig. 11.2 shows an object placed in front of a converging lens. The image of the object is shown on the other side of the lens.

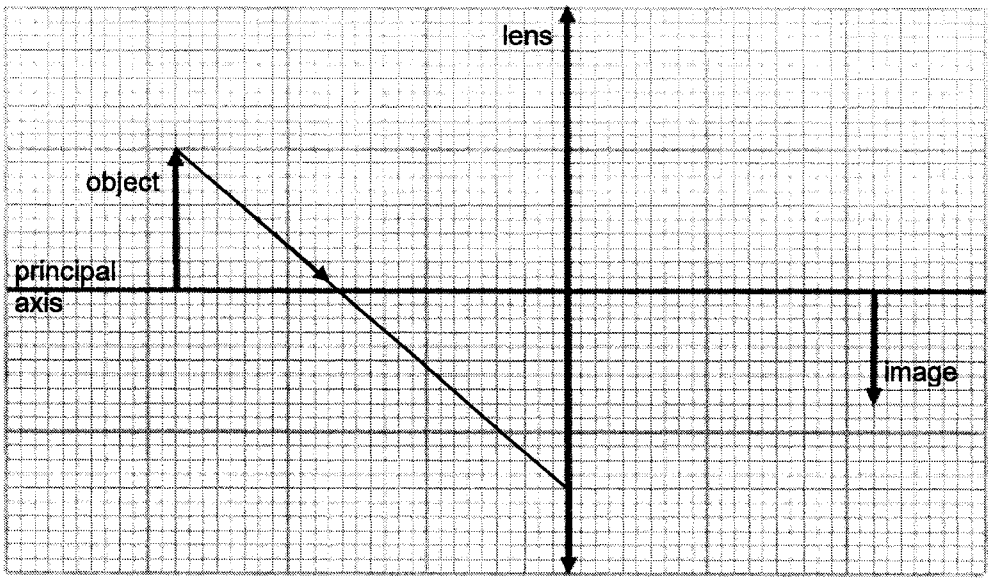


Fig. 11.2

An incomplete light ray has been given.

(i) Complete the ray diagram and determine the focal point of the lens. Mark and label the focal point with "**F**". [3]

(ii) The object is now placed at a distance nearer to the lens than the focal length of the lens.

Describe the characteristics of the image formed.

.....

.....[1]

[Total: 10]

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12 **(a)** Fig. 12.1 shows a simple d.c. motor. A rectangular coil PQRS is connected to a power supply and is placed between two solenoids.

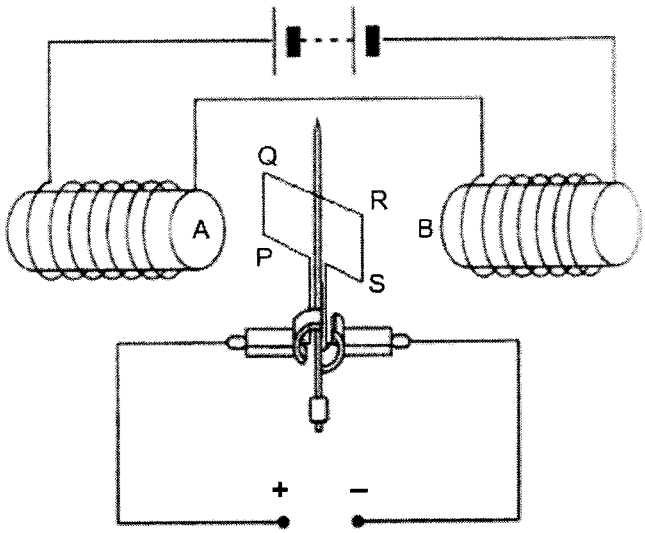


Fig. 12.1

(i) Identify the magnetic poles at A and B

A: .....

B: ..... [1]

(ii) Explain why the coil turns.

.....

.....

.....

.....[2]

(iii) Describe the action of the split-ring commutator in the d.c. motor.

.....

.....[1]

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(iv) When the coil is vertical, the split-ring commutator is not in contact with the carbon brushes and no current flows through the coil.

Explain why the coil continues to turn even though no current is flowing.

.....

.....[1]

(b) Fig. 12.2 shows the structure of a transformer which is used in the transmission of electrical power through the cables.

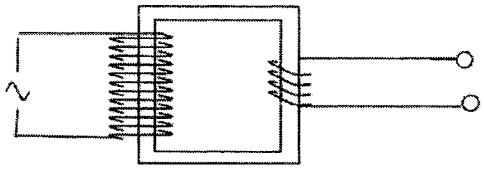


Fig. 12.2

Table 12.1

coil	number of turns
J	50
K	100
L	1 000
M	1 500

An engineer is assigned to build a step-down transformer for stepping down the voltage from 3.3 kV to 220 V in the substation of a housing estate. He has the choice of using four types of coils with different number of turns as shown in Table 12.1 above.

(i) Based on Table 12.1, select the most suitable pair of coils for making the primary coil and secondary coil of the transformer.

Show your working.

primary coil: .....

secondary coil: ..... [2]

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(ii) Assume that the transformer is 75 % efficient and the power output is 15 kW, calculate the current flowing in the primary coil.

current = ... [2]

(iii) Soft iron is used for the core of the transformer. Explain why a soft iron core is used.

.....

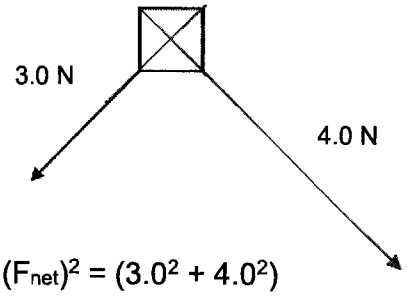
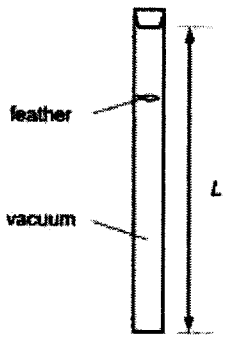
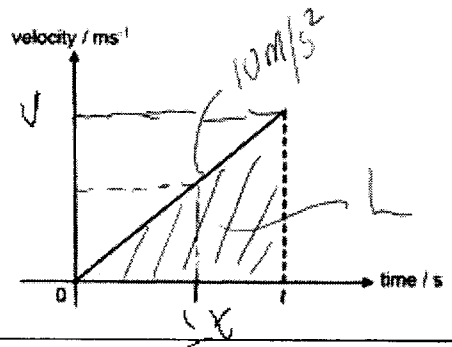
.....[1]

[Total: 10]

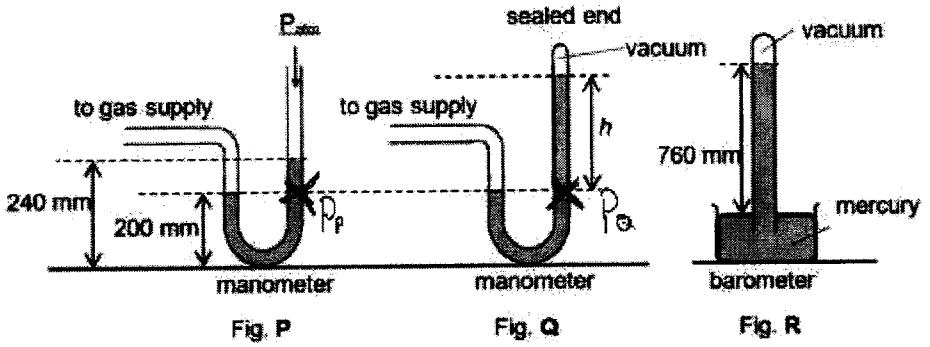
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Solution to Sec 4 Physics Prelim 2025 Paper 1

1	**C**	6	**D**	11	**B**	16	**C**	21	**B**	26	**D**	31	**B**	36	**B**
2	**C**	7	**C**	12	**D**	17	**D**	22	**B**	27	**B**	32	**C**	37	**D**
3	**A**	8	**B**	13	**A**	18	**B**	23	**D**	28	**A**	33	**C**	38	**C**
4	**C**	9	**D**	14	**C**	19	**C**	24	**D**	29	**C**	34	**C**	39	**C**
5	**B**	10	**A**	15	**A**	20	**B**	25	**C**	30	**A**	35	**B**	40	**B**

Qn	Solution	Ans
1	Derived: Energy, Force, Speed, Weight, Acceleration Base: Length, Mass, Time	C
2	12 kHz is within the human hearing range (20 Hz–20 kHz)	C
3	Weight, velocity and displacement are vectors; area, volume, distance, pressure, and temperature are scalars.	A
4	Graph with decreasing slope (gradient) = decreasing velocity.	C
5	Highest point reached is at 20 hr Area under v-t graph (triangle) = 0.5 × 20 × 5000 = 50,000 km.	B
6	Constant speed means net force is 0 → friction = 22 N.	D
7	Between 7.0 N and 4.0 N, the net force is 3.0 N in the direction of the 7.0 N.  $(F_{net})^2 = (3.0^2 + 4.0^2)$ $F_{net} = 5.0$ N	C
8	Free fall – Acceleration due to gravity – 10 ms^{-2}  	B

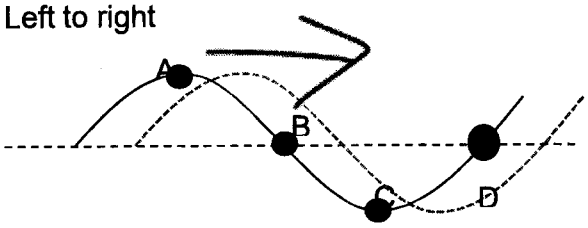
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	At t, Acceleration is a constant $a = (v- u)/ (t)$ $u = 0$ $v = at$ $L = ½ vt = ½ (at)t = ½ at^2$	At 0.5t, Acceleration is a constant $a = (v- u)/ (½ t)$ $u = 0$ $v_{(½ t)} = ½ at$ $L_{(½ t)} = ½ v_{(½ t)} (½ t) = ½ (½ at) (½ t)$ $= ½ at^2(¼) = ¼ L$	
9	Acceleration due to gravity is always 10 m/s² downward.		D
10	Inertia causes the ball to swing backward (towards the left) when the car moves right.		A
11	The toy is balanced. CG is directly below the point of contact with the table.		B
12	Use moments about one point: Tensions are 95.2 N and 74.8 N. Taking moments about Y, CW = ACW $(5.00) \times T_x = (2.50 \times 140) + (4.20 \times 30)$ $T_x = (350 + 126) / 5.00$ $T_x = 95.2$ N Upward forces = Downward forces $T_x + T_y = 140 + 30$ $T_y = 74.8$ N		D
13	Pascal's principle Force = 60 × (30/2) = 900 N; Conservation of energy, distance = (60×15)/900 = 1 cm.		A
14	 Same level, same liquid, same pressure		C

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	$P_P = P_Q$ $40 + P_{atm} = P_Q$ $P_{atm} = 760$ mm $P_Q = 760 + 40 = 800$ mm.	
15	Equal mass; density inversely proportional to volume: $P = \rho Q / 2$.	A
16	Using energy conservation: speed when hitting target = 12 m/s. $$\text{Initial total energy} = \text{Final total energy}$$ • Initial energy: $$E_i = \frac{1}{2}mv^2 + mgh_1 = \frac{1}{2}m(15)^2 + m \cdot 10 \cdot 1 = \frac{1}{2}m \cdot 225 + 10m = 112.5m + 10m = 122.5m$$ • Final energy: $$E_f = \frac{1}{2}mv^2 + mgh_2 = \frac{1}{2}mv^2 + 10m \cdot 5 = \frac{1}{2}mv^2 + 50m$$ • Equating initial and final energy: $$122.5m = \frac{1}{2}mv^2 + 50m$$ Cancel out m from both sides: $$122.5 = \frac{1}{2}v^2 + 50$$ $$\frac{1}{2}v^2 = 122.5 - 50 = 72.5$$ $$v^2 = 145$$ $$v = \sqrt{145} \approx \boxed{12.0\,\text{m/s}}$$	C
17	Work done = F × d is same → same KE.	D
18	Temperature increase → internal energy increase.	B
19	Power out = 100×20 = 2000 W. Efficiency = 2000 / 3000 = 0.67.	C
20	Compression → more collisions per unit time with walls.	B
21	Brownian motion shows air molecules are in constant random motion.	B
22	X is cooler because a dull surface is a good emitter. Explanation: 1. Surface Texture and Thermal Radiation: • A dull (matte) surface is both a good absorber and a good emitter of thermal radiation.	B

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	• A polished (shiny) surface is a poor absorber and a poor emitter of thermal radiation. 2. Cooling Process: • Both cans X (dull surface) and Y (polished surface) are filled with water at the same initial temperature (boiling point) and left in the room. • The cans cool down primarily by emitting thermal radiation to the surroundings. • Can X (dull surface) emits thermal radiation more efficiently than Can Y (polished surface), so it loses heat faster. • As a result, after a short while, the temperature of Can X will be cooler than Can Y.	
23	Same energy, different times → X has lower heat capacity.	D
24	Left to right  A is moving downwards but not with highest speed. B is moving with highest speed but moving upwards. C is moving upwards. D is moving downwards and with highest speed.	D
25	Wavefronts spread out more in deeper region. Larger the wavelength, larger the speed, when frequency remains constant. $v = f\lambda$	C
26	All EM waves same speed in vacuum; X-rays shorter λ.	D
27	Amplitude = 0.7 cm; wavelength = 22.8 cm from given data.	B
28	f = 50 Hz → T = 1/50 = 0.020 s. Rarefaction arrives in 0.010 s.	A
29	Matchstick must move 10 cm right to be at focal point. Application – As a spotlight	C
30	Electron moves opposite to field direction → down.	A
31	Energy = Q × V = 90 × 3×10^{10} = 2.7×10^{12} J.	B
32	X = metallic conductor, Y = diode, Z = filament lamp.	C
33	Voltage divider: V = 20 × R/(R+300) ≥ 12 → R ≥ 450 Ω.	C
34	Fuse should be on live wire to break circuit.	C

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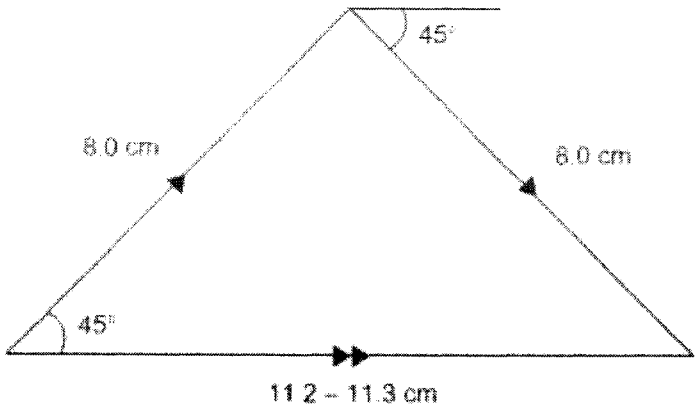
35	Compass aligns with field; use right-hand rule.	B
36	Iron affects compass, aluminium does not. Magnetic shielding – Field lines can go through aluminium but not through iron. Iron ring concentrates the magnetic fieldlines	B
37	Use Fleming's Left-hand Rule: current is into the paper. Field is upwards Force will be from the higher concentration of magnetic field lines to the lower concentration of magnetic field lines	D
38	The relay fails to attract the iron armature when the switch is turned on, meaning the electromagnet is not strong enough. Iron cores magnetize more easily than steel, making the electromagnet stronger. This ensures the armature is attracted when the switch is on. Other options (increasing distance, reducing coil turns, or lowering current) weaken the magnetic field, worsening the problem. Iron's higher permeability solves the relay's failure to conduct high current.	C
39	I = 600 A → Power loss = $I^2R = 5.4\times10^6$ W → ratio = 0.036.	C
40	60 → 29 is approximately 1 half life = 2.0 s	B

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Solution to 2025 Sec 4 Physics Preliminary Exam Paper 2

Section A

Qn	Solution	Mark
1	 Arrows direction [1] Shape [1] Scale 1.0 cm : 10 N [1] (can accept other reasonable scales) magnitude of resultant force =112 – 113 N [1] **Marker's Comments:** Students who did not get the full credit had one or more of the following issues: (1) Scale without unit. E.g., 1:10 instead of 1 cm rep 10 N. (2) Not indicating the resultant force with a double arrow. (3) Changing the orientation/direction of the 80 N vectors. This caused the resultant force to point in a wrong direction. Students should be mindful to keep the original direction of the vectors.	B4
2a	As the **speed increases,** the **air resistance** acting on the child and the sledge also **increases**. Hence the **resultant force decreases** and the **acceleration decreases**. [gradient is positive and decreasing] From 24 to 26s, the **forward force is equal to the backward force** and the **resultant force acting on the child and sledge is zero**. Hence, there is **no acceleration** and it **moves with a constant speed**. [gradient is zero] 1. **Speed increases, air resistance increases** 2. **Resultant force decrease, acceleration decreases** 3. **Forward force is equal to the backward force** 4. **Resultant force is zero** 5. **Zero acceleration – moves at constant speed** **5 points – 3 marks** **3 points – 2 marks** **2 points with coherence – 1 mark**	B1 B1 B1

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	Need to mention resultant force in each case to get the marks. **Marker's Comments:** Poorly attempted. Only a few students identified air resistance as the force opposing the motion. Almost all students cited friction instead and wrongly suggested that the magnitude of friction increases with speed.	
2b	The gradient of the graph becomes zero/ graph become horizontal from t = 24 s to t =26 s. **Need to state the time from t= 24s to 26s to get the mark.** **Marker's Comments:** Many students were able to describe the section of the graph which corresponded to terminal velocity but did not state the period when it happened.	B1
2c	Distance travelled = Area under the graph = ½ x (30-26) x 15.2 = 30.4 m Since the sledge stops in 30.4 m, **it will stop before hitting the wall** which is 35 m ahead. **Marker's Comments:** Some students tried to find the time taken for the child to stop completely and compared it with the graph. It was wrongly assumed that speed remained constant during the braking period.	M1 A1
2d	The energy in the gravitational potential store is transferred to energy in the internal store. OR Gravitational potential energy to thermal / internal energy **Note: the speed is constant, there is no changes in energy in the kinetic store. Reject any answers that mention kinetic store.** **Marker's Comments:** Poorly attempted. Almost all students included kinetic energy/store in their response. As stated in the note above, there was no change to the amount of energy in the kinetic store.	B1
2e	The child **experience inertia** where his **body mass resists a change in state of motion** / and **continue to move forward**. **Inertia + resist a change in state of motion / continue to move forward**	B1

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	Marker's Comments: Generally well done.	
3a	As the **boom angle increases**, the **perpendicular distance between the load and the pivot decreases**. Since the **moment is the product of the force and the perpendicular distance**, a **decrease in the perpendicular distance allows for an increase in the force (load)** while maintaining the same moment. Hence, the maximum load the boom can support increases. **Formula of moments = F x d is needed.** **Marker's Comments:** Some students did not use the information given in the table and explained their answers based on the concept of stability instead. Others misinterpreted that the increase in boom angle meant that the perpendicular distance to the pivot increased.	B1 B1
3bi	Moment = F x d = 11 500 x 22 = 253 000 Nm **Marker's Comments:** Generally well done.	M1 A1
3bii	By taking moments about X, Clockwise moments = Anti-clockwise moments 253 000 = W x 5 W = 50 600 N (allow ecf) **Marker's Comments:** Generally well done.	M1 A1
4a	The gas molecules collide / exert a force on the wall of the container / surface of mercury. **Marker's Comments:** Generally well done.	B1
4b	The gas pressure is higher than atmospheric pressure. **Marker's Comments:** Many students attempted the question with a similar approach as (a), missing the point that the gas pressure was higher than atmospheric pressure.	B1

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4c	$P_{gas} = P_{Hg} + P_{atm}$ $P_{gas} = \rho \times g \times h + 760mmHg$ $P_{gas} = 13600 \times 10 \times 80/1000 + 13600 \times 10 \times 760/1000$ $P_{gas} = 110000$ (2 sf) / 114000 Pa (3 sf) **Marker's Comments:** Poorly attempted. Most common mistake made was in converting 760mmHg to Pa. Students did not do one or more of the following: (1) divide 760mm by 1000, (2) multiply by 13600kg/m3 for the density of mercury, (3) multiply by 10 N/kg for the gravitational field strength. Students are advised to write down the mathematical statements as marks can be awarded in some contexts.	M1 A1
4d	When the gas cooled down, the average kinetic energy of the molecules decreases. The gas molecules bombard the wall of the container less frequently and less forcefully. Hence, the gas pressure decreases. This will cause the difference in the mercury level to reduce. **Marker's Comments:** Generally well done. Students were able to write down the essential points in their description.	B1 B1 B1
5ai	$Q = mc\Delta\Theta$ $Pt = mc\Delta\Theta$ $450 \times t = 2.0 \times 900 \times (100 - 25)$ $t = 300$ s OR 5.0 mins (2 s.f) **Marker's Comments:** Generally well done. Some students who converted their answers to minutes forgot to express their answer in 2 s.f. which resulted in penalisation of 1 m. Students are advised not to make unnecessary conversion as it increases the chance of errors.	M1 A1
5aii	D. Highest melting point so it can withstand the heat/won't melt so easily OR Smallest specific heat capacity so temperature will rise fastest for the same amount of thermal energy supplied Any 1 point – 1 mark **Marker's Comments:**	B1 B1

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	Generally well done. Some students who identified A as their answer thought that a higher specific heat capacity meant more energy transferred to the food. They should note that the source of the energy is the stove so using Q= mcΔΘ, a higher specific heat capacity would cause a smaller change in temperature.	
5b	Q = mlv 5 190 000 = 2.3 x lv lv = 5 190 000 / 2.3 =2 256 522 J / kg = 2300 000 J/kg (2 s.f) **Marker's Comments:** Students were able to do the calculations but were not able to write down the correct unit. Many wrote J/kg°C. °C should not appear in the unit as the process and equation does not involve change in temperature.	M1 A1
6a	Transverse wave The wave propagates in the direction perpendicular to the direction of the source of vibration. **Marker's Comments:** Generally well done. Some students were careless in their response and wrote that "The wave propagates in the direction perpendicular to the direction of the **wave motion**" which did not make sense.	B1 B1
6bi	Period = 60 / 45 = 1.33 s ¾ x 1.33 = 1.0 s (2 s.f) **Marker's Comments:** Poorly attempted. Only a handful of students were able to get the correct answer. The motion of R in the next instant is down not up. So between R and S is ¾ wave. Almost all students assumed that it was ¼ wave.	M1 A1
6bii	f = 45 /60 = 0.75 Hz V = f λ 24 = 0.75 x λ λ = 32 cm RS = 16 cm (2 s.f) **Marker's Comments:** Generally well done.	 M1 A1

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7a	Straight Arrows **correctly drawn from the positive plate to the negative plate**. **Direction is consistent and correct** across all drawn field lines. Fieldlines are equally spaced. **Marker's Comments:** Many students did not get the mark for fieldlines that are equally spaced. Mark is deducted for additional and incorrectly drawn fieldlines.	B1 B1
7b	The sand grains are **positively charged**. This is because they are **attracted to the negatively charged metal plate**, and **unlike charges attract**. **Marker's Comments:** A number of students were confused. The sand grains are on the positive plate. So they become charged positive **by contact**. And then they get attacted to the negatively charged plate.	B1 B1
7c	Potential difference, V = 1500 V Charge, Q = 4.0×10^{-4} C Energy=Q×V Energy=4.0×10^{-4} × 1500=0.60 J (2 s.f) **Marker's Comments:** Students who didn not get these marks, recalled the formula worngly. Others lost the mark for s.f.	M1 A1
8a	Tungsten wire has a **higher resistivity,** and a coil filament is **longer** compared to uncoil one, hence **resistance of lamp A is higher**. Since brightness depends on power, $P = I^2R$. Since R for Lamp A is greater, lamp A is brighter. **Marker's Comments:** There was a lot of misconception for this question. Resistivity is NOT Resistance. Resistivity is a material property. $R = \rho l/A$	B1 B1

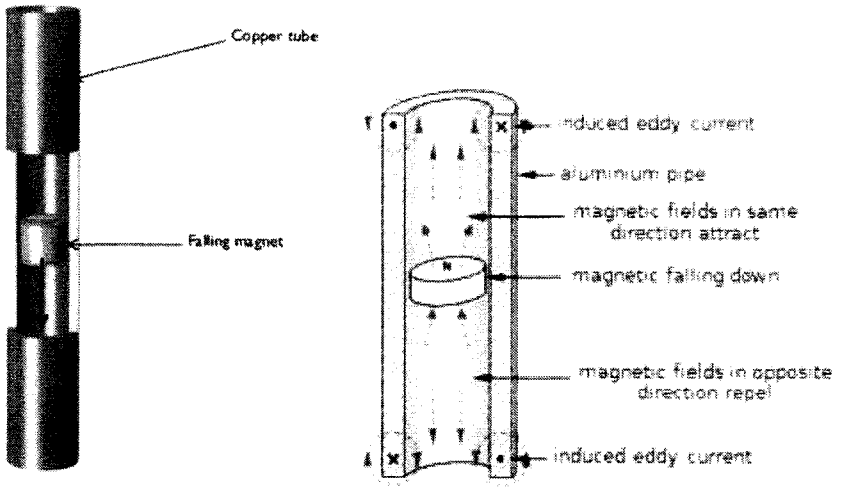
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	Coiled means the length of the wire is longer. Hence, Tungsten wire has a higer resistivity and is longer. Therefore, resistance is greater. When both lamps carry the same current (e.g. in series), the power converted to heat/light in the filament is $P = I^2R$. With its larger R, A dissipates more power, reaches a higher temperature, and so glows brighter.	
8b	When the non-ohmic filament lamps A and B are connected in **series**, their resistances decrease compared to when they are connected in **parallel**. This happens because: **Lower Current in Series → Less Heating** • In a series circuit, the same current flows through both lamps, but the total resistance is higher, reducing the overall current. **(Explains lower current in series → less heating → lower resistance.)** • Since the filaments are non-ohmic, their resistance depends on temperature. **(Recognizes that non-ohmic resistance depends on temperature.)** • A lower current means less power dissipation ($P=I^2R$), so the filaments heat up less. Lower temperature, lower resistance. **Marker's Comments:** Many students could not make this basic connection: Filament lamps are non-ohmic: their resistance increases with temperature (6091 outcome: I–V characteristic of a filament lamp). In series, the same current flows through both lamps and the current is smaller than in parallel for a given supply. Hence the power in each lamp, $P= I^2R$ is lower. ⇒ Each filament runs cooler, so its resistance drops **(temperature ↓ → R ↓)**. In parallel, each lamp receives the same p.d., draws a larger current, so $P=VI$ (and I^2R) is higher. ⇒ Each filament runs hotter, and its resistance rises.	B1 B1 B1
8c	The **fuse will still melts/blows** and the **lamp appears off**. However, the metal case is still live and can cause **electrocution or shock** **Marker's Comments:**	B1 B1

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	Fuse wrongly placed in the earth wire; live wire touches the metal case Fault: live wire contacts the metal case → a large current flows from live → case → earth wire. this large current blows the fuse. Consequences: metal case remains live, if a user touches the metal case, current can pass through the body to earth, causing a severe electric shock.	
9a	Ke = ½ mv^2 = ½ x 18 000 x 12 x 12 = 1 296 000 J = 1.3 x 10^6 J (2 s.f) **Marker's Comments:** Careless.. Wrong substitution. S.f. errors. For an easy enough question.	M1 A1
9b	(500 000 / 1 296 000) x 100% = 38.5 % = 38% or 39 % (2 or s.f) Allow ecf **Marker's Comments:** Many students did not recall the formula for efficiency. Those that did, substituted incorrectly.	A1
9c	When the diameter is 20 m, the power is 500kW, but when the diameter is 40 m, the power is 2000 kW, which is 4 times the power. **Marker's Comments:** This question is very straightforward. Students are to read off the information provided and draw conclusions.	B1 B1
9d	Intermittent power as it is not easy to find steady wind blowing. Any other valid answer will be accepted **Marker's Comments:** Well answered. Answer in TB. Students are encouraged to know the advantages and disadvantages of all forms of energy resources stated in the syllabus.	B1

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9e	As the coils rotates, there is **a change in magnetic flux linking to the coil** which induces an e.m.f. **Marker's Comments:** A recall question which was very poorly attempted. This is basically the definition of electromagnetic induction.	B1
9f(i)	North **Marker's Comments (for both 9f (i) and (ii)):** This application illustrates the phenomenon of eddy current braking. A cylindrical magnet falling through a copper tube induces eddy currents on the tube walls. The eddy currents, in turn, create a magnetic field that opposes the magnetic field of the magnet and induces a braking force that opposes the motion of the magnet. This opposing force increases with increasing velocity. Thus, there is a terminal velocity at which the magnetic braking force equals the force of gravity.  	B1
9f(ii)	The magnitude of the induced e.m.f is **proportional to the rate of the change of the magnetic flux in the circuit**. As the magnet fall, it accelerates due to acceleration due to gravity. A **larger speed** will produce a larger rate of change of the magnetic flux in the circuit. **Marker's Comments** Very few students made this connection.	B1 B1

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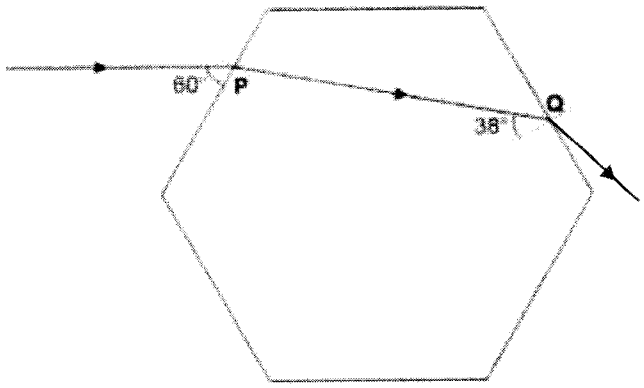
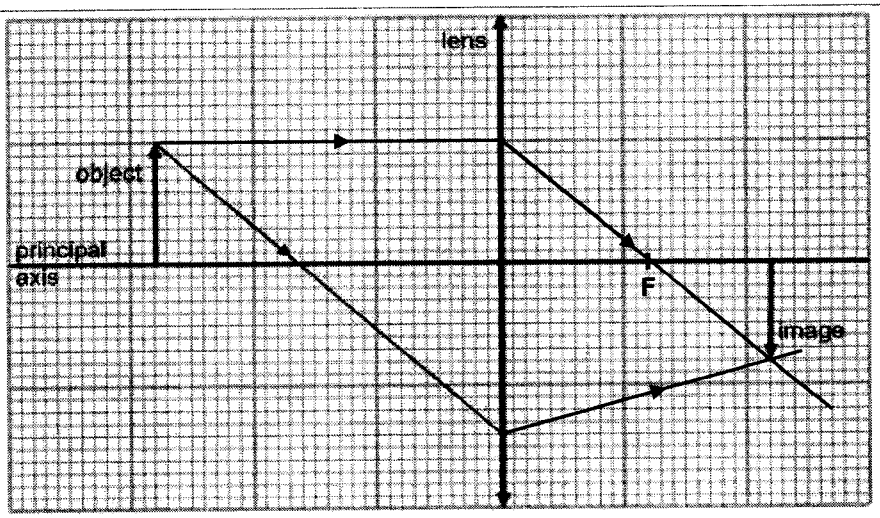
10a	Remove any radioactive source from the vicinity before using a radiation detector to read the radiation count **Marker's Comments:** Recall Q. Was revised in Timed Practice.	B1
10b	6 half-life – working must be shown 125 counts per min **Marker's Comments:** For a basic calculation question, students could have done it better.	B1 B1
10c	Alpha radiation cannot penetrate through the body for detection. It has high ionizing power, thus it is harmful to the body cells. **Marker's Comments:** For a basic recall question, students could have done it better.	B1 B1
10d	Source Y Able to last the examination period but not to remain in the blood for too long. **Marker's Comments:** This requires students to be realistic. There is a process to doing the examintaion of the patient which will take time. So exactly 15 mins, which is source X is incorrect.	B1 B1
10e	$_{-1}^{0}\beta$ OR $_{-1}^{0}e$ **Marker's Comments:** Some students did not know how to write this.	B1
10f	any 2 points: □ keep a distance, e.g. use tongs □ point source away (from user) □ use a barrier, e.g. wear lead apron □ use a lead container to store/transport sources □ administer within a short time or monitor with film (badge) **Marker's Comments:** There must be clarity in such recall answers. Some students confused with biological hazards.	B1 B1

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Section B

Qn	Solution	Mark
11ai	$n = \sin i / \sin r$ $1.42 = \sin 30° / \sin r$ $1 \times \sin 30° = 1.42 \times \sin r$ $r = 20.616°$ $= 20.6°$ (3 sf) **Marker's Comments:** Many students wrongly identified 60° as the angle of incidence. Students should be more careful and check for the angle of incidence/refraction in diagrams.	M1 A1
11aii	The critical angle is the angle of incidence in the optically denser medium for which the angle of refraction in the optically less dense medium is 90°. **Marker's Comments:** A significant number of students were not able to provide a satisfactory definition, omitting either the optical medium or mentioning total internal reflection.	B1
11aiii	$n = 1 / \sin c$ $1.42 = 1 / \sin c$ $c = \sin^{-1}(1/1.42)$ $= 44.766°$ $= 44.8°$ (3 sf) **Marker's Comments:** Generally well done.	M1 A1

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11aiv	 ray bends away from normal **Marker's Comments:** Many did not attempt this part of the question. It is likely that they did not see the question.	B1
11bi	 [1] complete given ray [1] construct rays to locate F [1] F **Marker's Comments:** Most students were able to draw the ray to locate the focal point. However, almost all were not able to complete the ray at the bottom. Students should observe that light rays originating from the tip of the object will have to converge at the tip of the image. Some students wrongly assumed that the bottom ray that passed through the principal axis was the focal point.	B1 B1 B1

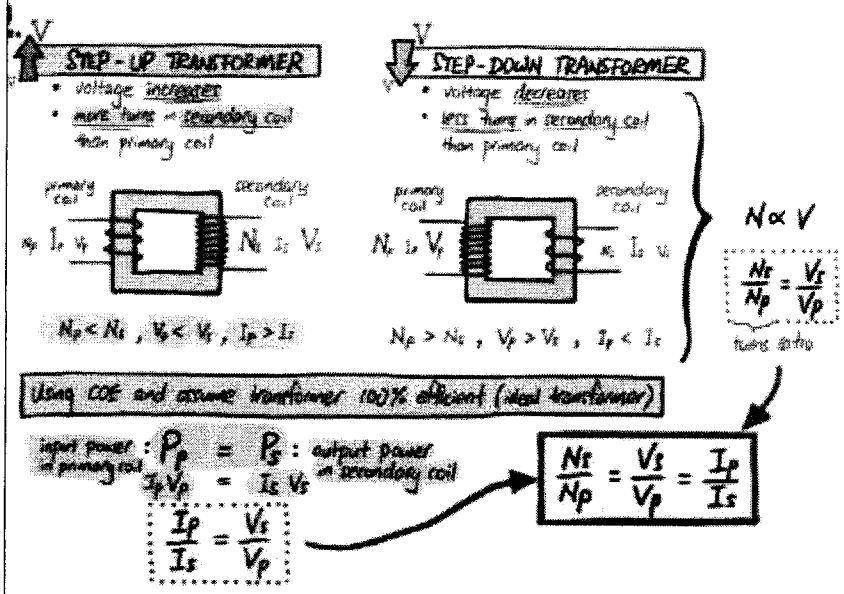
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11bii	The image formed is <u>magnified, upright and virtual</u> **Marker's Comments:** Many students were unable to visualise the scenario and thus were not able to state the characteristics.	B1

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12ai	A : North B: South **Marker's Comments:** Basic Right Hand Grip Rule	B1
12aii	Magnetic field of current interacts with magnetic field of magnet Downward force acting on PQ. Upward force acting on RS causing the coil to turn. Need to state clearly direction of force on each side of coil. (use Flemming's left hand rule to determine direction of force) **Marker's Comments** Students need to differentiate between Electromagnetism (DC Motor) and Electromagnetic Induction (AC Generator).	B1 B1
12aiii	Ensures the **current** in the circuit **reverses for every half revolution** **Marker's Comments** Recall. Poorly attempted.	B1
12aiv	Due to **inertia / momentum**, the coil continues to turn though current is not flowing in coil in vertical position. **Marker's Comments** Recall. Poorly attempted.	B1
12bi	Ratio of turns = Ratio of voltage 3300 / 220 = 15 *1500 / 100 = 15 Select M as Primary coil K as Secondary coil **Marker's Comments** Well attempted.	 M1 A1
12bii	Power in Secondary = 0.75 x Power in Primary 15 000 = 0.75 x I x V 15 000 = 0.75 x I x 3300 I = 6.06 A (2 or 3 s.f) 75% efficient means output power is 75% of input power **Marker's Comments** Many students did not know how to apply the equation for efficiency. The approach is using conservation of energy.	 M1 A1

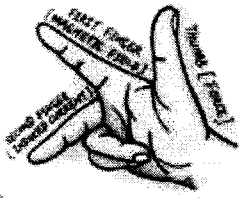
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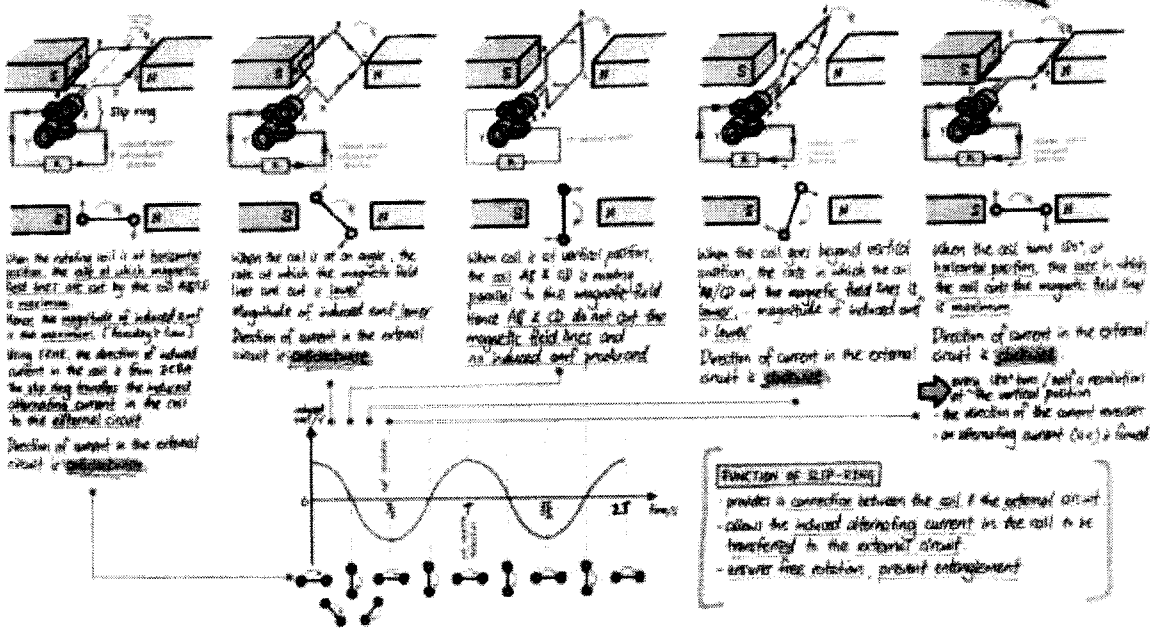
		
12biii	To ensure **maximum magnetic flux linkage** of primary coil with secondary coil by **concentrating magnetic field lines**. Accept if a student is able to mention one of the two bolded ideas. **Marker's Comments** While soft iron has properties such as easily magnetized / demagnetized, etc → in this context, only these 2 points mentioned provide the advantage of using a soft iron core in a transformer.	B1

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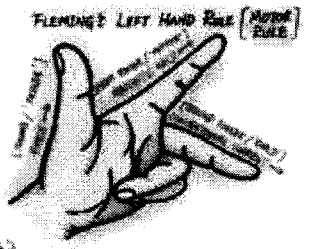
MECHANICAL ENERGY to ELECTRICAL ENERGY

ac generator
SLIP RING





DC MOTOR
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