CONVENT OF THE HOLY INFANT JESUS SECONDARY
Preliminary Examination in preparation for
the General Certificate of Education Ordinary Level 2025

CANDIDATE NAME

CLASS

REGISTER NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

03 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet (OMR)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on 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

1 A textbook lists the average width of a human hair as 0.0001 m and the distance between the Earth and the Sun as 1.5×10^{11} m.

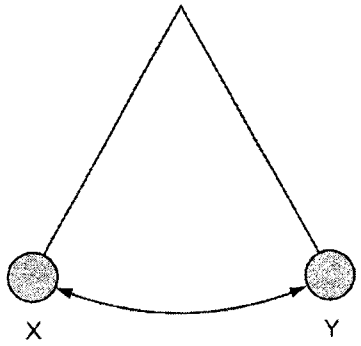
How are these values expressed with prefixes?

	average width of a human hair	distance between the Earth and the Sun
A	1.0×10^{-1} mm	1.5×10^{-1} Tm
B	1.0×10^{-1} mm	1.5×10^{-1} Gm
C	1.0×10^{-1} μm	1.5×10^{-1} Gm
D	1.0×10^{-1} μm	1.5×10^{-1} Tm

2 What is the unit of pressure expressed in base units?

A kg / ms^2 **B** kg / ms **C** kg^2 / ms^2 **D** kg / m^2s^2

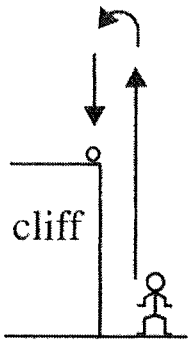
3 A pendulum is set in motion and 20 complete swings are timed. The time measured is 30 s.



What is the period and the shortest time *t* for the pendulum to swing from X to Y?

	period / s	time *t* / s
A	0.75	0.75
B	0.75	1.5
C	1.5	1.5
D	1.5	0.75

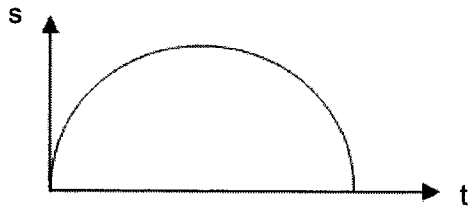
4 A robot standing at the bottom of a cliff shoots a ball upwards. The ball drops on top of the cliff after reaching a maximum height of 125 m in 5 s.



What is the height of the cliff given that the ball reaches the top of the cliff 7 s after the shoot? (Take g = 10 m/s^2 and the height of the robot to be negligible)

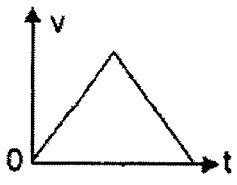
A 125 m **B** 115 m **C** 110 m **D** 105 m

5 The diagram shows the graph of displacement s against time t for a body moving in a straight line.

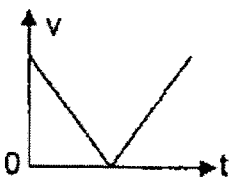


Which is the graph of speed v against time t for this body?

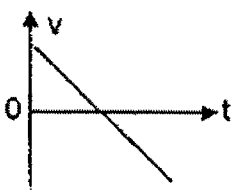
A



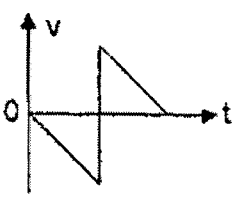
B



C



D

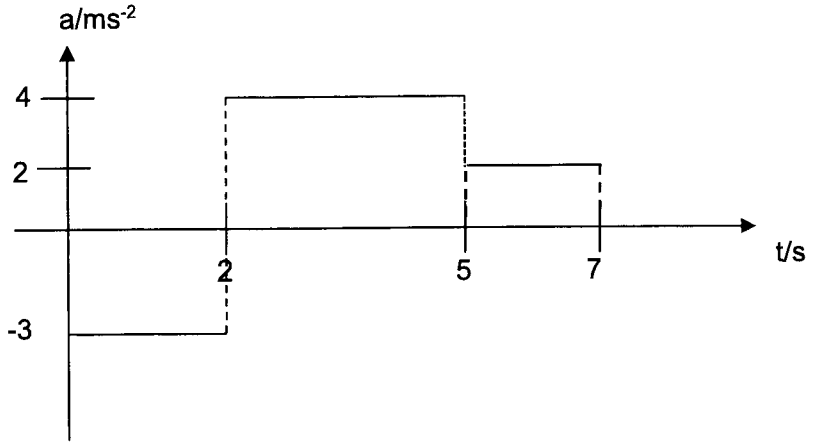


6 A bus has a total mass of 12 000 kg. it moves along a horizontal stretch of road at a speed of 10 m/s. It then accelerates, reaching a final speed of 30 m/s after 16 s.

What is the size of the average resultant force acting on the bus when it is accelerating?

A 7500 N **B** 9600 N **C** 15 000 N **D** 22 500 N

7 The graph shows the acceleration-time graph of a toy car.

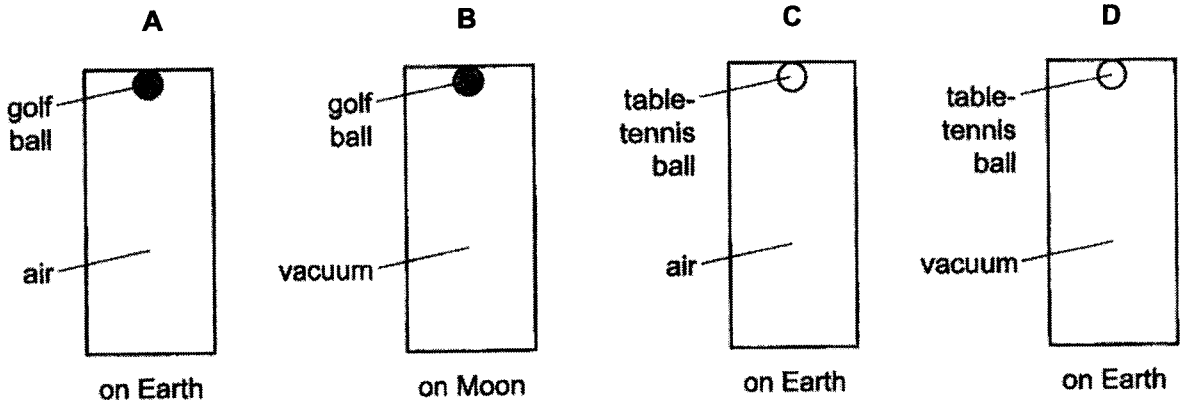


If the toy car starts off with an initial velocity of 10 ms^{-1}, what is its velocity at the 7th second?

A -10 ms^{-1} **B** 10 ms^{-1} **C** 20 ms^{-1} **D** 30 ms^{-1}

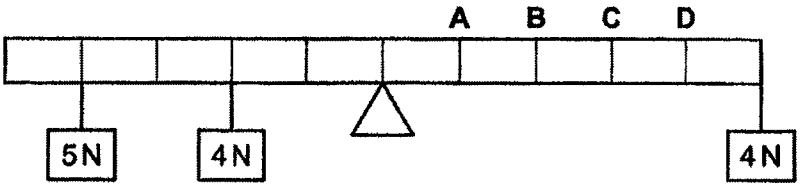
8 The diagrams show four experiments in which a ball falls from the top to the bottom of identical sealed glass tubes.

In which experiment does the ball take the shortest time to reach the bottom of the tube?



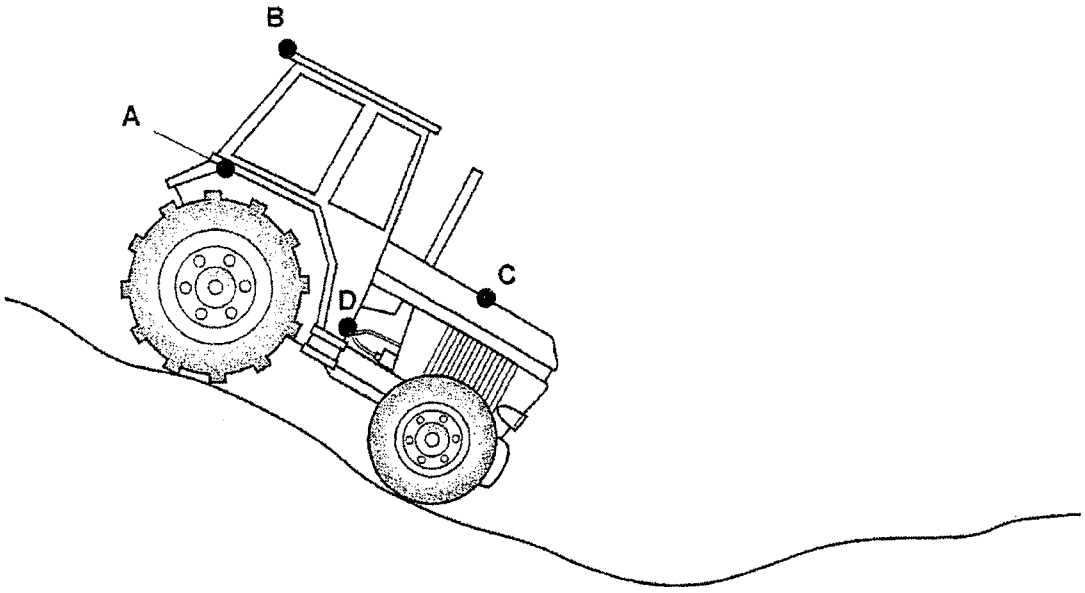
9 The diagram shows a uniform beam with three weights hung on it.

At which point does a load of 2 N balance the beam?

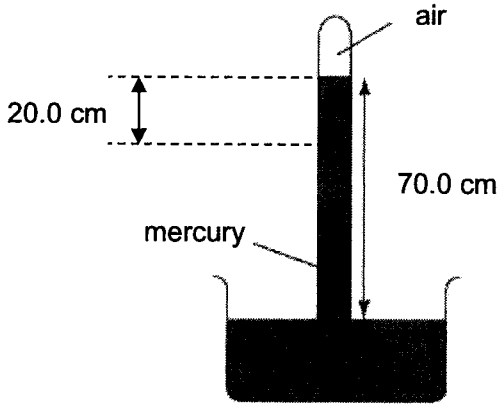


10 A tractor is being used on rough ground.

Where should the position of its centre of gravity be for the tractor to topple?



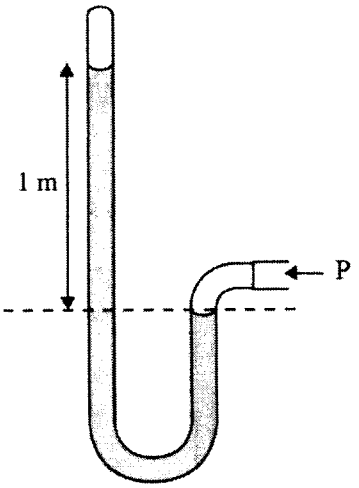
11 The diagram shows a barometer containing some air in the space above the mercury column. The height of mercury column is 70.0 cm. X is a point 20.0 cm below the surface of the mercury in the tube. The atmospheric pressure is 76.0 cmHg.



What is the pressure at point X in the mercury?

A 56.0 cmHg **B** 50.0 cmHg **C** 26.0 cmHg **D** 20.0 cmHg

12 A closed tube manometer is connected to an air pump as shown. The manometer is filled with water of density 1000 kg/m^3 and the pressure exerted by the trapped air is 190 kPa.



What is the air pressure caused by the air pump?

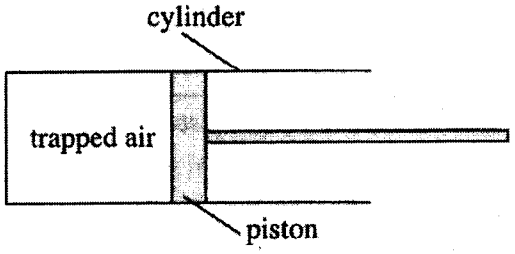
A 10 kPa **B** 190 kPa **C** 200 kPa **D** 210 kPa

13 An electric motor took 20 s to lift a 500 N load through a vertical height of 8.0 m.

If the efficiency of the motor is 40 %, how much is the electric input power to the motor?

A 80 W **B** 120 W **C** 333 W **D** 500 W

14 A gas is trapped in a cylinder with a movable piston as shown. The temperature of the gas is kept constant as the piston is pulled out of the cylinder.



What happens to the gas particles?

A They collide with the cylinder walls more frequently.

B They expand.

C They get further apart.

D They move slower.

15 Heat capacity is the energy required to raise the temperature of the object by 1 °C.

What does this energy do?

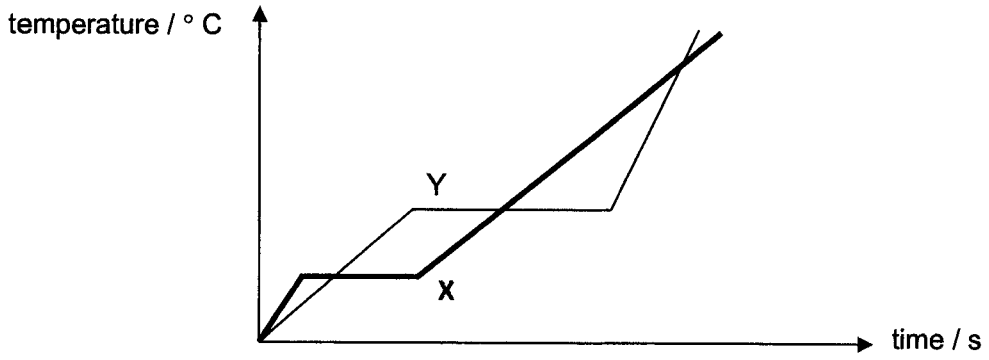
A It increases the internal potential energy of the solid molecules.

B It increases the vibration among the solid molecules.

C It increases the average size of the solid molecules.

D It increases the forces of attraction between the solid molecules.

16 Equal masses of two solids X and Y are heated successively in a well-lagged calorimeter. Thermal energy is supplied to both at the same rate. The temperature-time graph for the process is shown.



Which statement below is correct?

A Solid X has a larger specific heat capacity than solid Y.

B Liquid X has a smaller specific heat capacity than liquid Y.

C Solid X has a smaller specific latent heat of fusion than solid Y.

D Solid X has a smaller specific latent heat of vaporization than solid Y.

17 Four bars, all exactly the same size, are each placed with one end in boiling water.

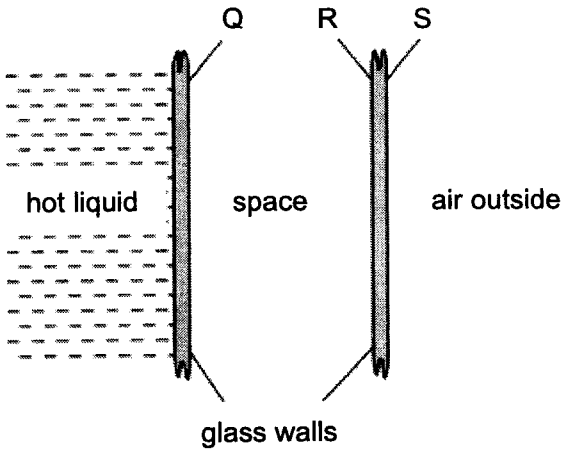
The times taken for the temperature of the other end to increase by 2 °C are measured.

material of bar	time for 2 °C rise / s
copper	5
aluminium	10
cork	800
styrofoam	1200

To make a large metal tank with the least heat loss, which materials should be used for the tank and its insulation?

	tank	Insulation
A	aluminium	cork
B	aluminium	styrofoam
C	copper	cork
D	copper	styrofoam

18 A student uses a double-walled glass vessel to contain a hot liquid.



Which method reduces the heat loss by radiation?

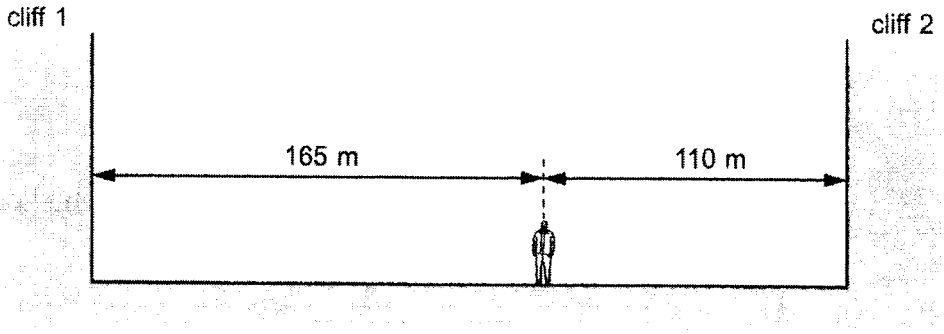
A creating a vacuum in the space between the glass walls

B painting surface Q black

C painting surface R black

D painting surface S white

19 A man stands between two cliffs and claps his hands once.

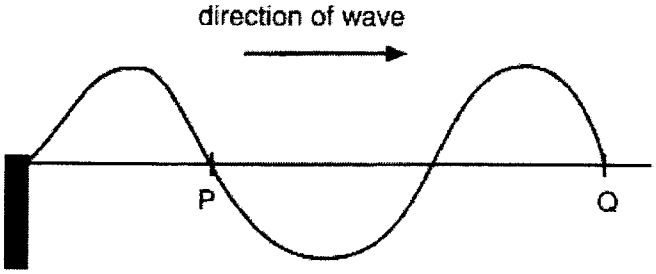


An echo is heard which is closely followed by another.
The speed of sound is 330 m/s.

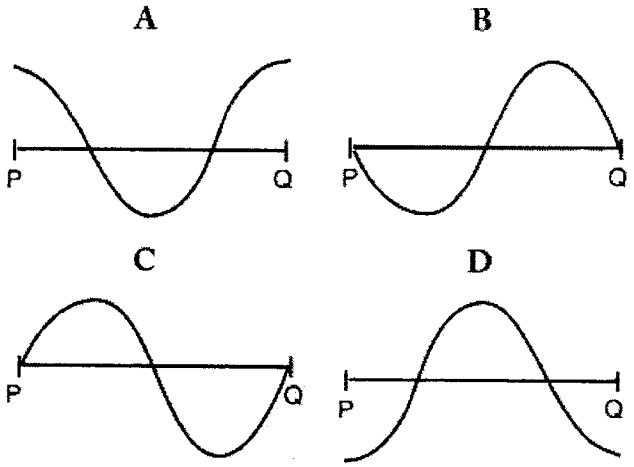
What is the time interval between the two echoes?

A 0.17 s **B** 0.33 s **C** 0.67 s **D** 0.83 s

20 A vibrator generates a travelling wave on a string. The diagram shows the shape of the string at a certain instant.



Which is the correct shape of the string between P and Q after half a period?



21 When ultrasound travels from air into water, what happens to its frequency, wavelength and speed?

	frequency	wavelength	speed
A	remains the same	reduced	reduced
B	remains the same	increased	increased
C	remains the same	increased	reduced
D	increased	increased	increased

22 The frequency of a note with high pitch is greater than the frequency of a note with low pitch.

Which statement about the note with high pitch is correct?

A It has a longer wavelength.

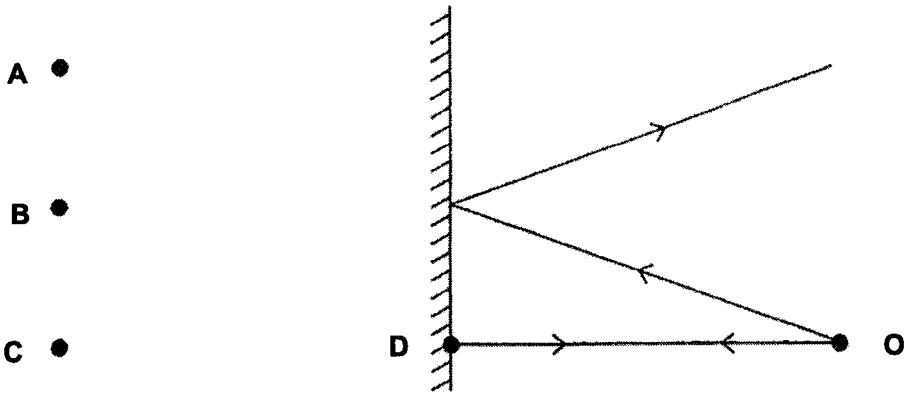
B It has a shorter wavelength.

C It has a greater speed in air.

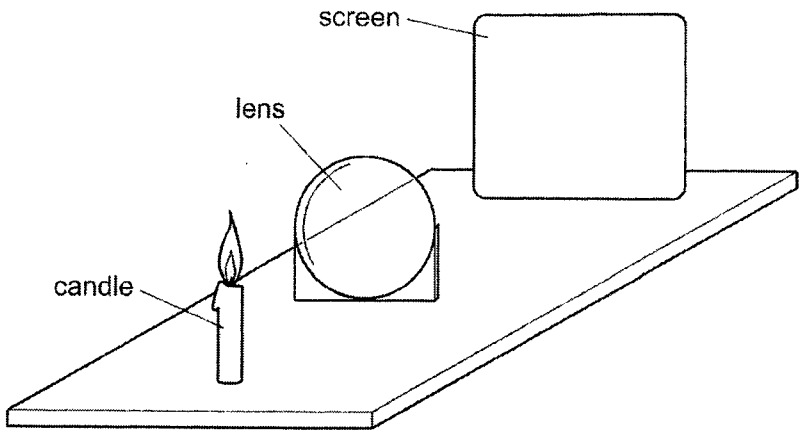
D It has a slower speed in air.

23 The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position will the image be formed?



24 A thin converging lens is used to produce, on a screen, a focused image of a candle.



Various focused images are produced on the screen by moving the lens and the screen backwards and forwards.

Which statement is **always** correct?

A The image is at the principal focus (focal point) of the lens.

B The image is bigger than the object.

C The image is closer to the lens than the object is.

D The image is inverted.

25 Statements 1 and 2 refer to signals passing through an optical fibre of refractive index 1.5.

1 The speed of the signal in the optical fibre is less than 3.0×10^8 m/s.
2 The angle of incidence of the signals in the optical fibre must be greater than 41.8 °.

Which statement(s) is/are correct?

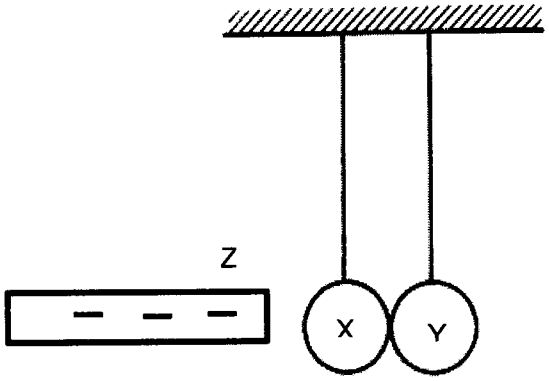
A neither of the statements

B both statements 1 and 2

C statement 1 only

D statement 2 only

26 A negatively charged rod is brought near two neutral spheres X and Y, which are in contact. Y is momentarily earthed and Z is then removed.



What happens to the charge distribution on X and Y?

	X	Y
A	negative	negative
B	negative	positive
C	positive	positive
D	positive	negative

27 A battery supplies a current of 0.5 A to a circuit consisting of two identical resistors in series.

If the work required to move the electrical charges through each resistor is 300 J per minute, what is the e.m.f. of the battery?

A 10 V **B** 20 V **C** 75 V **D** 150 V

28 A cell is connected to a resistor.

What is the electromotive force of the cell equal to?

A the potential difference across the resistor for each unit of current

B the power produced in the circuit for each unit of charge that passes the resistor

C the work done in the circuit for each unit of charge that passes the resistor

D the work done in the circuit for each unit of current

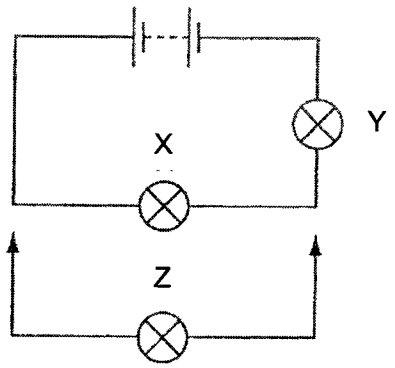
29 A resistor with resistance R is made from a length L of resistance wire with a cross-sectional area A.

A second resistor with twice the resistance of the first resistor is made from wire of the same material with a cross-sectional area 2A.

What is the length of the second resistor?

A L / 2 **B** L **C** 2L **D** 4L

30 The diagram shows identical lamps X and Y connected in series with a battery. The lamps light with normal brightness.



A third identical lamp Z is connected in parallel with lamp X.

What happens to the brightness of lamp Y?

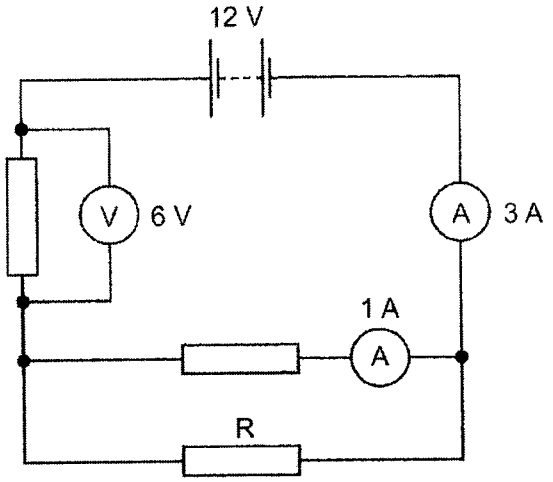
A brighter than normal

B normal

C dimmer than normal

D very dim (cannot be seen)

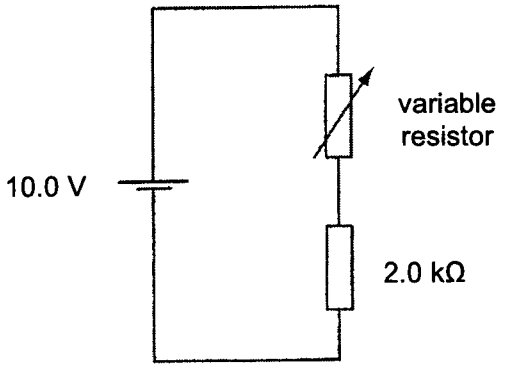
31 The circuit diagram shows three different resistors and three meters with their readings.



What is the value of resistor R?

A 2 Ω **B** 3 Ω **C** 4 Ω **D** 6 Ω

32 A variable resistor is connected in series with a fixed resistor of resistance 2.0 kΩ and a 10.0 V supply.



The resistance of the variable resistor can vary from 2.0 kΩ to 8.0 kΩ

What is the range of possible values for the potential difference across the variable resistor?

A 2.0 – 8.0 V

B 2.0 – 10.0 V

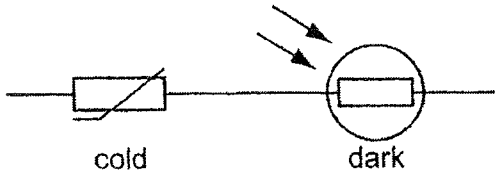
C 5.0 – 8.0 V

D 5.0 – 10.0 V

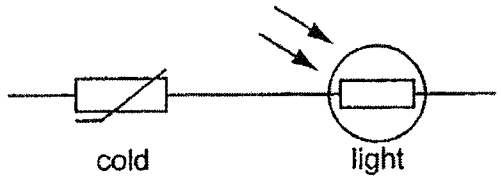
33 A thermistor and a light-dependent resistor are connected in series to a power supply.

Which conditions will result in smallest current flowing through them?

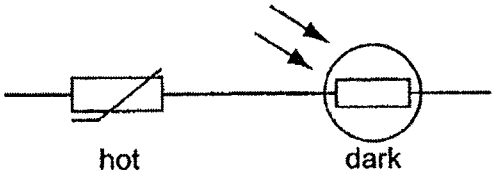
A



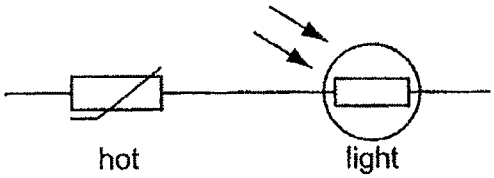
B



C



D



34 An electric cooker has a hotplate rated at 1500 W and an oven rated at 2000 W.

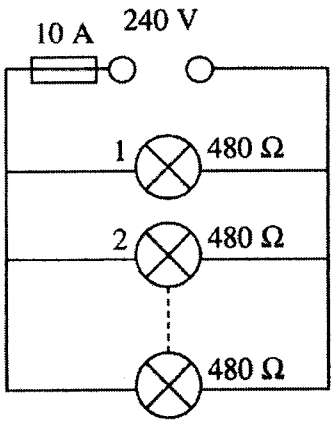
During one day, the hotplate is switched on for a total of 1.0 hour and the oven is switched on for 3.0 hours.

The cost of electricity is 30 cents per kWh.

What is the cost of using the electric cooker for one day?

A 225 cents **B** 420 cents **C** 2250 cents **D** 225 000 cents

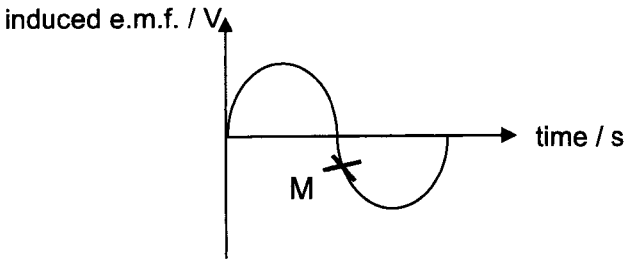
35 Lamps are connected in parallel in the circuit as shown. The fuse rating is 10 A and the resistance of each lamp is 480 Ω.



What is the maximum number of lamps that can be connected without blowing the fuse?

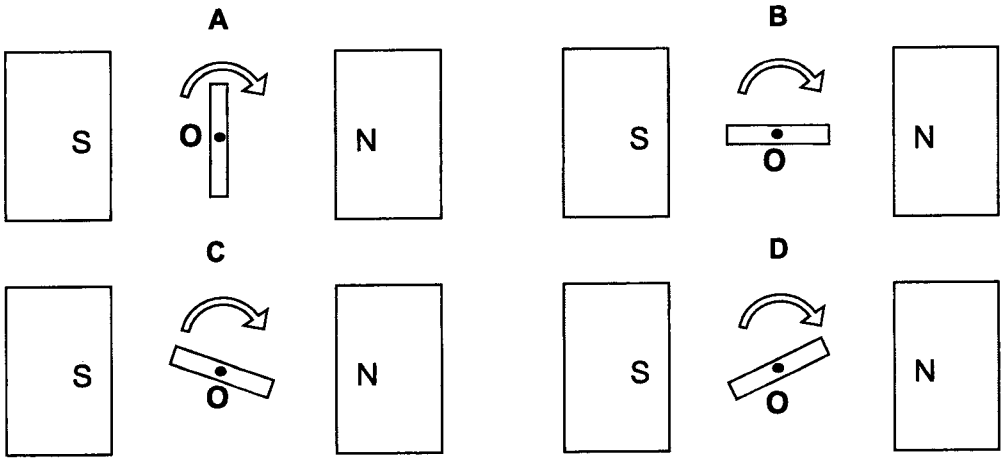
A 2 **B** 10 **C** 19 **D** 20

36 The graph shows how the induced e.m.f. of a simple a.c. generator varies with time.

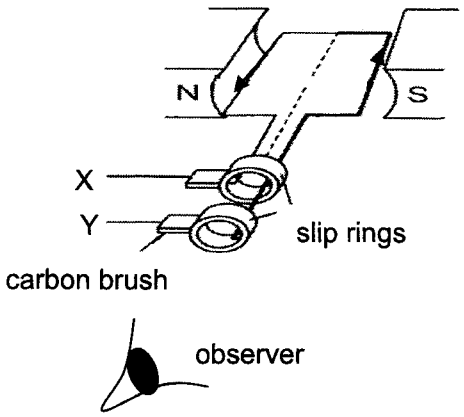


The diagrams below show the front view of the coil of an a.c. generator. The coil is being rotated about an axis through O in a uniform magnetic field.

Which of them shows the position of the coil when the value of the induced emf is at M?



37 The diagram shows an a.c. generator connected to leads X and Y. The current direction in the coil is as shown.

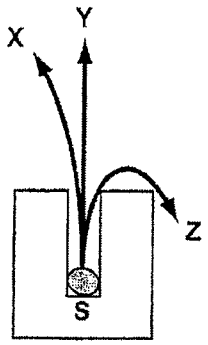


Which row shows the direction of rotation of the coil as seen by an observer and the rule used to obtain the direction of current as shown?

	direction of rotation	rule used
A	clockwise	Fleming's left hand rule
B	clockwise	Flemin's right hand rule
C	anti-clockwise	Fleming's left hand rule
D	anti-clockwise	Flemin's right hand rule

38 The diagram shows the emission of alpha, beta and gamma radiations from a source S within a lead block.

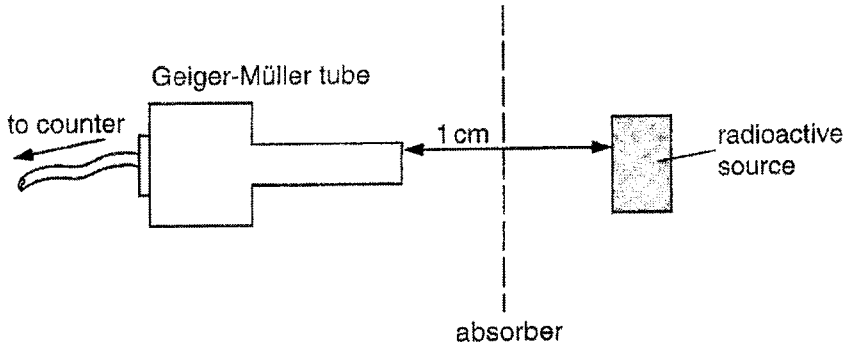
There is a strong magnetic field present.



What are the names of the radiation X, Y and Z?

	X	Y	Z
A	alpha	beta	gamma
B	alpha	gamma	beta
C	beta	alpha	gamma
D	beta	gamma	alpha

39 A student investigates the penetrating power of radiation from a radioactive source.



The table shows her results.

background count	25 counts per minute
count with source only	630 counts per minute
count with source and paper absorber	630 counts per minute
count with source and aluminium absorber 3mm thick	180 counts per minute

The source emits

A alpha and beta particles.

B beta particles and gamma rays.

C beta particles only.

D gamma rays only.

40 Atoms P and Q are isotopes.

How does the composition of neutral atoms of P compare with neutral atoms of Q?

	number of protons	number of neutrons	number of electrons
A	different	different	different
B	different	same	same
C	same	different	same
D	same	same	different

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20

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CONVENT OF THE HOLY INFANT JESUS SECONDARY
Preliminary Examination in preparation for
the General Certificate of Education Ordinary Level 2025

CANDIDATE NAME

CLASS

REGISTER NUMBER

PHYSICS

6091/02

Paper 2 Structured and Free Response

02 Septemeber 2025

1 hour 45 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.
Write in dark blue or black ink.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write yours answers in the spaces provided.

Section B
Answer **one** question.
Write yours answers in the spaces provided.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.

The number of marks is given in brackets [ ] at the end of each question or part question.

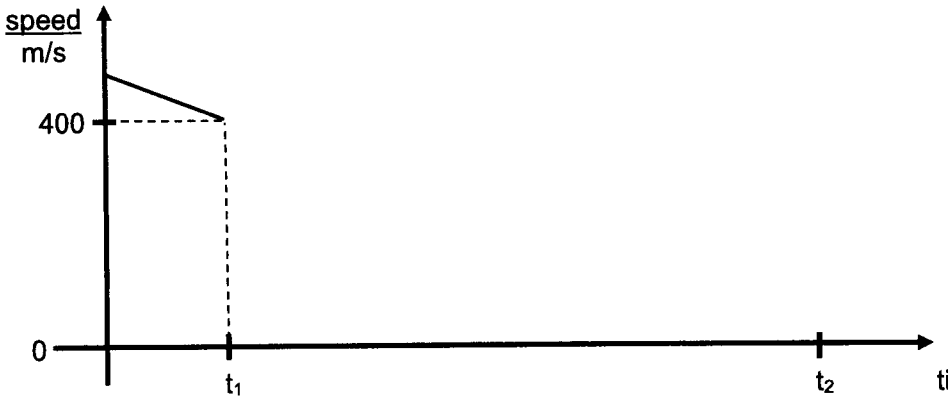
Section A

Answer **all** the questions in this section.

1 A small spacecraft, known as Mars Express, is to land on the planet Mars.

As the spacecraft enters the planet's atmosphere, it slows down. When the speed reaches 400 m/s, parachutes open and friction with the atmosphere increases. The spacecraft eventually reaches a steady speed, and then finally it hits the surface.

(a) On the axes of Fig. 1.1, complete the speed-time graph for the spacecraft. The parachutes open at time t_1, and the spacecraft hits the surface of Mars at time t_2.



[2]

Fig. 1.1

(b) State what is meant by a *gravitational field*.

.....

.....

.....[1]

(c) The mass of the spacecraft is 65 kg. At one point the gravitational field strength of Mars is 3.0 N/kg and the total upwards force on the spacecraft is 500 N.

Determine

(i) the weight of the spacecraft,

weight = ...[1]

(ii) the resultant force on the spacecraft,

resultant force = ...[1]

(iii) the deceleration of the spacecraft.

deceleration = ...[2]

[Total: 7]

2 Fig. 2.1 shows a stone supported by two strings that hang from a rod.

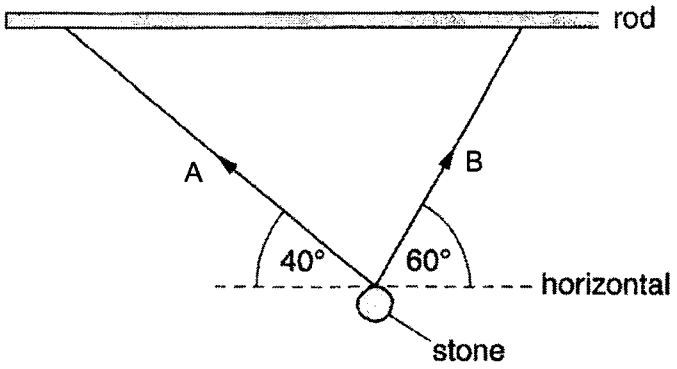


Fig. 2.1

The stone is stationary, and the weight of the stone is 2.6 N.
The resultant of the two tensions, A and B, is equal in magnitude to the weight of the stone.

(a) In the space below, draw a scaled diagram to show the resultant of the two tensions.
State the scale used.

Using the scaled diagram, determine the magnitude of the two tensions, A and B.

scale = ...

tension A = ...

tension B = ...

[Total: 4]

[Turn over

3 Fig. 3.1 shows a roller coaster in an amusement park. The total mass of the roller coaster and its passengers is 2000 kg. The speed of the roller coaster is 35 m/s at Y, which is the lowest point of the track. Z is the top of the next hump and is 20 m above ground.

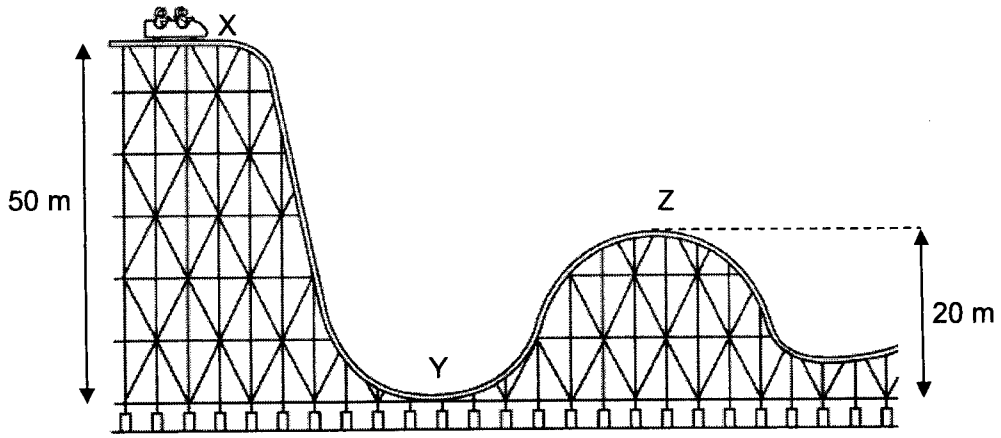


Fig 3.1

(a) Calculate the amount of energy in the kinetic store of the roller coaster at Y.

amount of energy in kinetic store at Y = ...[2]

(b) Assuming there is no friction along the track from X to Y, calculate the speed of the roller coaster at X.

speed at X = ...[3]

(c) The speed of the roller coaster is 4.0 m/s at Z and the track between Y and Z is 40 m long. Calculate the average force of friction between the roller coaster and the track from Y to Z.

average force of friction = ...[2]

[Total: 7]

4 Fig. 4.1 shows a heavy piston supported by gas trapped in a cylinder.

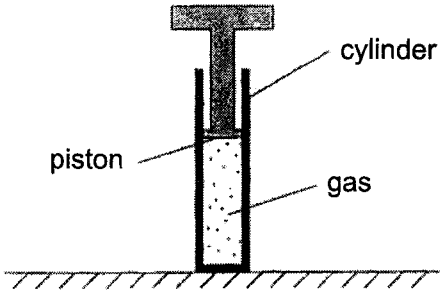


Fig. 4.1

(a) The cross-sectional area of the piston is 4.0×10^{-4} m^2. The pressure of the gas inside the cylinder is 2.0×10^5 Pa and atmospheric pressure is 1.0×10^5 Pa. The acceleration of free fall is 10 m/s^2.

Determine the mass of the piston.

mass = ...[3]

(b) With the same piston in the cylinder, the cylinder is brought up to the top of a very high mountain.

State and explain how the position of the piston in the cylinder will change.
Assume the temperature of the gas remains the same.

.....

.....

.....[2]

[Total: 5]

[Turn over

5 Fig. 5.1 shows an electric kettle containing some water.

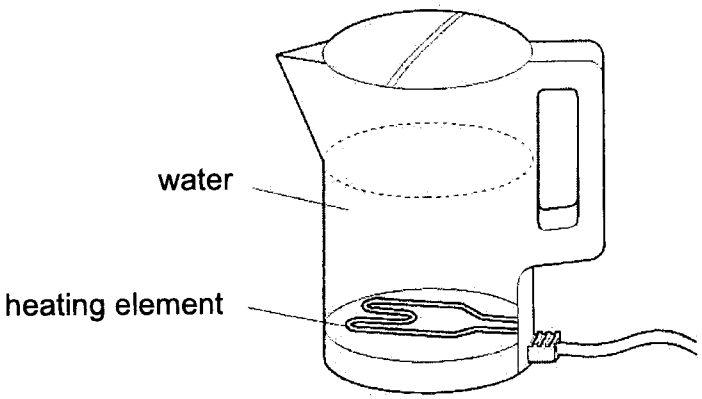


Fig. 5.1

(a) The specific heat capacity of water is 4200 J/kg°C.
Explain the meaning of "*specific heat capacity of water is 4200 J/kg°C*".

.....

..... [1]

(b) The 2.5 kW electric kettle contained 1.50 kg of water at 27 °C.
The kettle was switched on for a period of time.

Assuming there is no energy lost to the surrounding and the kettle, how long would it take for the mass of water in the kettle to decrease to 1.00 kg?
Specific latent heat of vaporisation of water is 2260 000 J/kg.

time taken = ... [3]

(c) When the kettle is switched off, the water cools down as evaporation takes place.

(i) Explain, at the molecular level, why the temperature of water decreases as evaporation takes place.

.....

.....

.....

.....[2]

(ii) The latent heat of vaporisation is taken in by the water molecules as they leave the water surface.

State how the components of the internal energy of these water molecules change as they evaporate.

.....

.....

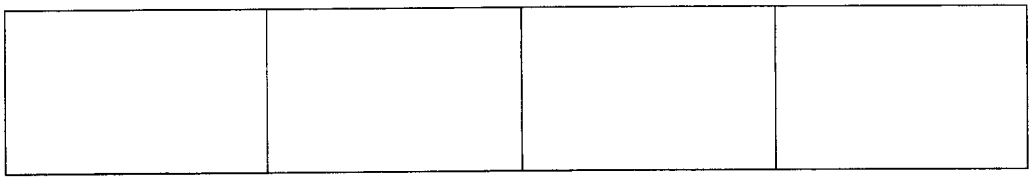
.....[2]

[Total: 8]

6 Microwaves, X-rays, infrared and ultraviolet are different types of radiation in the electromagnetic spectrum.

(a) Write the name of one of these types of radiation in each of the boxes, placing them in order of increasing wavelength.

shortest wavelength ⟶ longest wavelength



[2]

(b) State two uses of infrared radiation.

1. .....

.....

2. .....

.....[2]

(c) State one property that all types of radiation in the electromagnetic spectrum have in common.

.....

.....[1]

[Total: 5]

7 **(a)** State one physical quantity of light that changes as it enters from one optical medium to another optical medium.

.....[1]

(b) State one physical quantity of light that does not change as it enters from one optical medium to another optical medium.

.....[1]

(c) On Fig. 7.1, draw a ray diagram to show how a converging lens is used in an overhead projector.

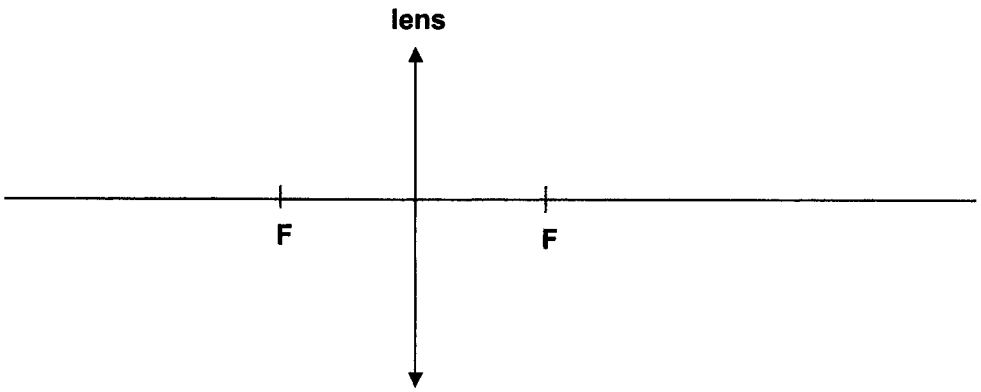


Fig. 7.1

[2]

(d) On Fig. 7.2, draw a ray diagram to show how a converging lens is used in a photocopier to produce identical copies of the same piece of document.

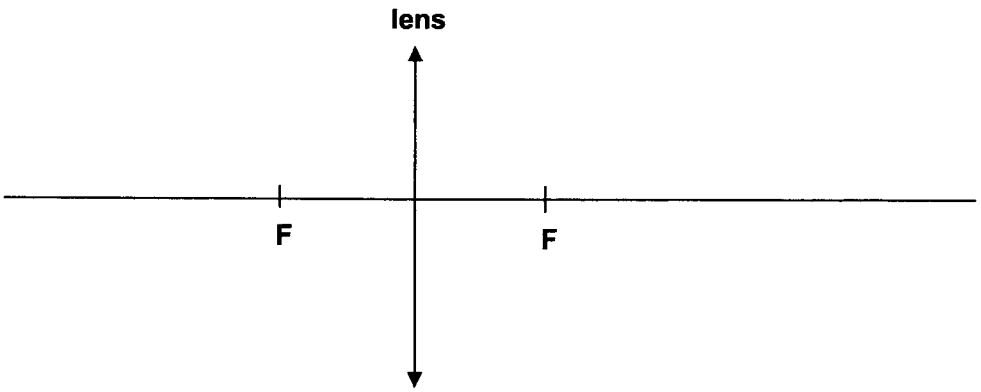


Fig. 7.2

[2]

[Total: 6]

8 Fig. 8.1 shows a simple d.c. motor.

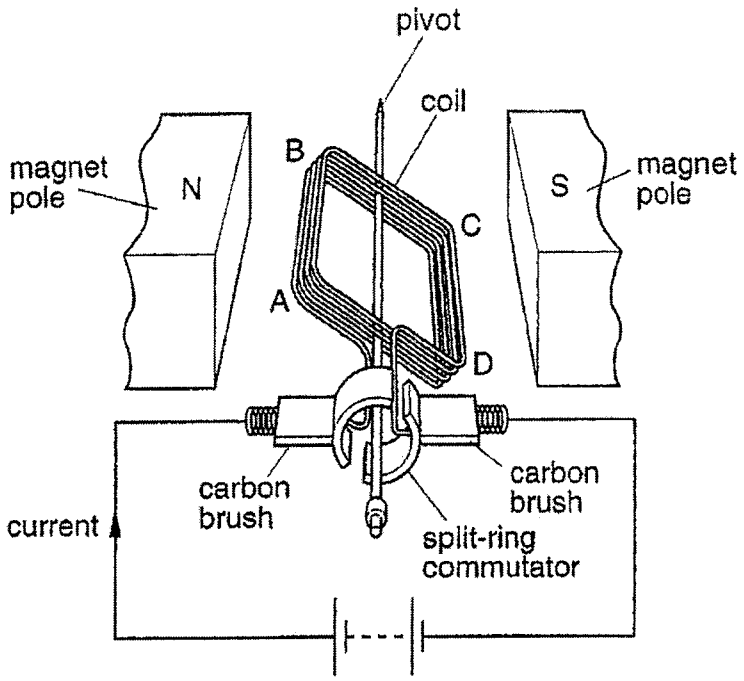


Fig. 8.1

The gap between the two halves of the split-ring commutator is so wide that a carbon brush can only touch one half of the split-ring at any time.

The coil is rotated by vertical forces that act along side AB and CD. The current causes a constant force of 5.0 N on each side. The moment created by these forces varies as the coil turns. The moment is a maximum when the coil is horizontal.

The distances AD and BC are both 0.070 m.

(a) Explain why

(i) the carbon brushes must **not** be allowed to touch both halves of the split-ring at the same time,

.....

.....[1]

(ii) sometimes the motor does **not** start when switched on, even if there is no friction.

.....

.....[1]

(b) (i) State the direction of the vertical force (upwards or downwards) on the side AB of the coil at the instant shown in Fig. 8.1.

.....[1]

(ii) Explain why vertical forces exist on AB and CD.

.....

.....

.....[2]

(c) (i) Calculate the maximum moment created on the coil.

maximum moment =..... [2]

(ii) Explain why the moment is maximum when the coil is horizontal.

.....

.....[1]

[Total: 8]

9 Typhoons create waves on the surface of the ocean.

Fig. 9.1 shows data on the speed and wavelength of some water waves. The waves travel in deep water of depth 5000 m or in shallow water of depth 10 m.

	wavelength / m	10	50	100	200	300	400	500	600
depth 5000 m	speed / ms^{-1}	4.0	7.8	12.8	17.9	22.2	25.0	28.1	30.6

	wavelength / m	10	50	100	200	300	400	500	600
depth 10 m	speed / ms^{-1}	4.0	7.5	9.2	9.7	9.9	10.1	10.1	10.1

Fig. 9.1

(a) For the range of wavelength in Fig. 9.1, state

(i) a similarity in the speed of water waves in deep and shallow water,

.....

.....[1]

(ii) a difference between the speed of water waves in deep and shallow water.

.....

.....[1]

(b) A typhoon, 2000 km away from a stationary ship, forms quickly. It generates water waves for a short period of time.

The waves, with wavelengths between 10 and 600 m, travel across an ocean of depth 5000 m to the ship.

(i) Calculate the time taken (in hours) for the first wave to reach the ship.

time = ... [2]

(ii) Calculate the frequency of the first wave to reach the ship.

frequency = ... [2]

(iii) Determine, to the nearest 100 m, the wavelength of the wave that arrives 4 hours after the first wave.

wavelength = ...[2]

(iv) As the first wave arrive at the ship, describe

1. the motion of the ship,

.....

.....[1]

2. the effect on the ship of the increase in frequency of the waves that arrive.

.....

.....

.....[1]

[Total: 10]

10 A radioactive source and a detector are used to check the level of fruit juice in a carton. Cartons of fruit juice pass between the detector and the radioactive source, as shown in Fig. 10.1. The radioactive source emits beta particles.

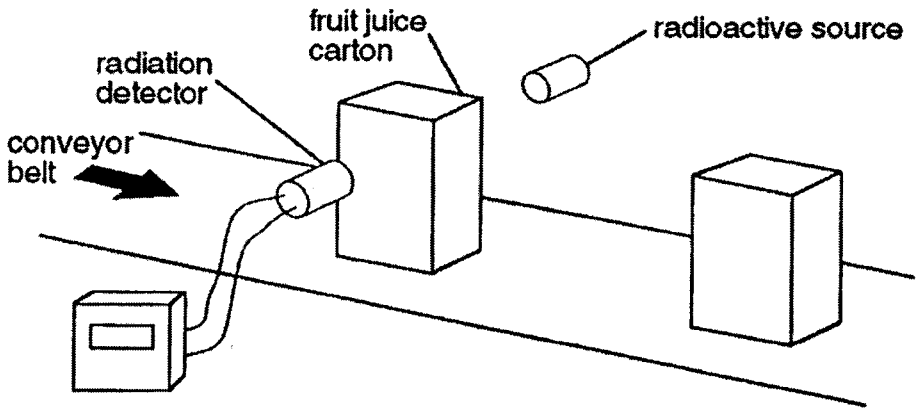


Fig. 10.1

(a) State the name of a suitable detector of the beta (β) particles.

.....

.....[1]

(b) What is a β particle?

.....[1]

(c) Explain why the level of detected radiation decreases when a full carton of juice goes past the detector.

.....

.....[1]

(d) Explain why a source emitting alpha (α) particles or gamma (γ) radiation is not used.

.....

.....

.....

.....[2]

(e) A radioactive isotope of radon (Rn-220) is represented as $^{220}_{86}Rn$. The nucleon number (mass number) of this nuclide is 220 and the proton number (atomic number) is 86. Radon-220 decays into polonium (Po-216) by the emission of an α particle.

(i) State the number of neutrons in a nucleus of Rn-220.

.....[1]

(ii) The nuclear equation that represents the decay of Radon-220 can be written as

$$^{220}_{86}\text{Rn} \rightarrow {}^{216}_{\cdots\cdots}\text{Po} + {}^{\cdots\cdots}_{\cdots\cdots}\alpha$$

Complete it by adding the missing nucleon number and proton number of the α particle and the missing proton number for the polonium nucleus. [2]

(f) Radon-220 has a half-life of 1.5 minutes.

(i) What is meant by "half-life" in radioactivity?

.....

.....[1]

(ii) A sample of radon-220 has 7.68×10^{12} atoms.

How long will it take for the sample to reduce its number to 3×10^{10} atoms?

.....[1]

[Total: 10]

Section B

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

11 **(a)** A lamp is marked 24 V, 100 W. Describe an experiment to check that the electrical power supplied to the lamp when the potential difference (p.d.) across it is 24 V.

In your account you should:

- include a circuit diagram
- state the readings that are taken
- show how the result is calculated from the readings.

.....

.....

.....

.....

.....[4]

(b) In Fig. 11.1 two lamps are connected in parallel to a 240 V mains supply.

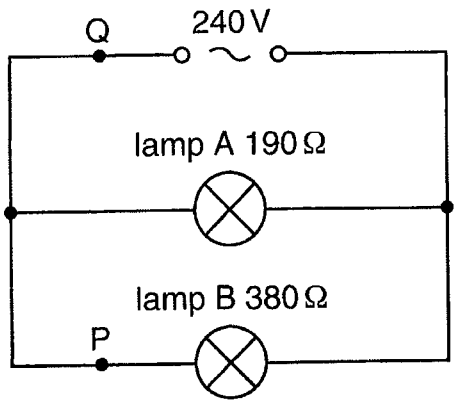


Fig. 11.1

Lamp A has resistance of 190 Ω and lamp B has a resistance of 380 Ω.

(i) Calculate the current at points P and Q.

current at P = ...

current at Q = ...

[2]

(ii) Calculate the total resistance of the circuit.

resistance = ...

[2]

(c) In a house, all lamps are connected in parallel to the mains supply, not in series.

Suggest two reasons for this.

1 .....

.....

2 .....

.....

[2]

[Total: 10]

12 Fig. 12.1 shows a thin sheet of metal suspended from a hole in one corner at A. The weight of the metal is 0.10 N and the centre of gravity is at B. The diagram is drawn full scale.

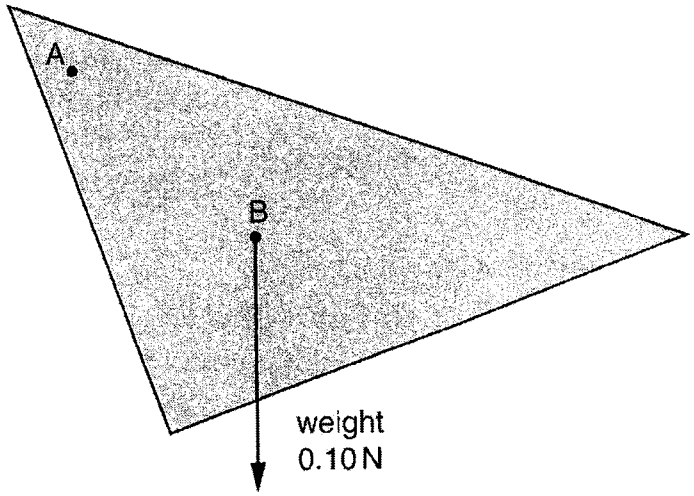


Fig. 12.1 (full scale)

(a) Describe how you would determine the position of the centre of gravity of the sheet of metal.

.....

.....

.....

.....

.....

.....

.....

[4]

(b) The sheet turns because of the moment of the weight about point A.

Using a distance measured on Fig. 12.1, calculate the moment of the weight about point A.

State the distance that you measured and your final answer for the moment.

distance measured = ...

moment =.....

[3]

(c) Fig. 12.2 shows a thick piece of wood with one corner on a table.
Fig. 12.3 shows the same piece of wood balanced on the table.
B is the centre of gravity.

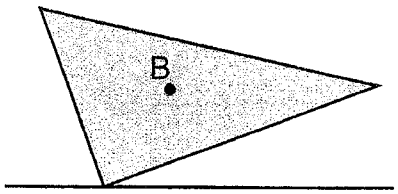


Fig. 12.2

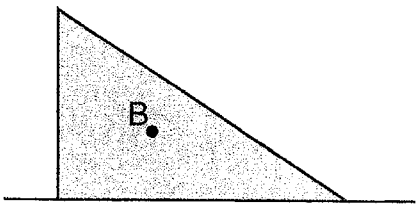


Fig. 12.3

(i) State why, in Fig. 12.2, the piece of wood falls to the right.

.....

.....

[1]

(ii) State why the piece of wood in Fig. 12.3 does not fall over.

.....

.....

[1]

(iii) Suggest how the thickness of the wood in Fig. 12.3 affects its stability.

.....

.....

[1]

[Total: 10]

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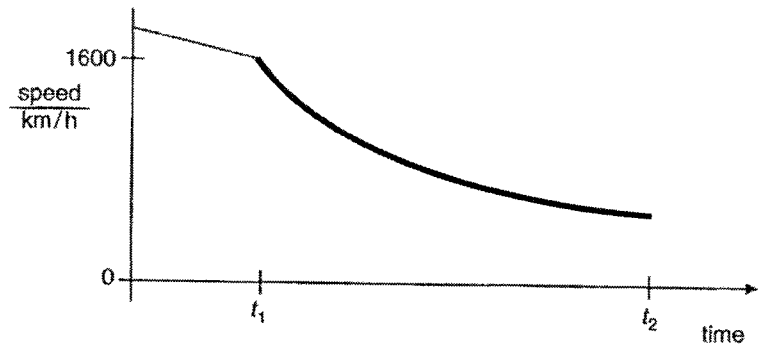
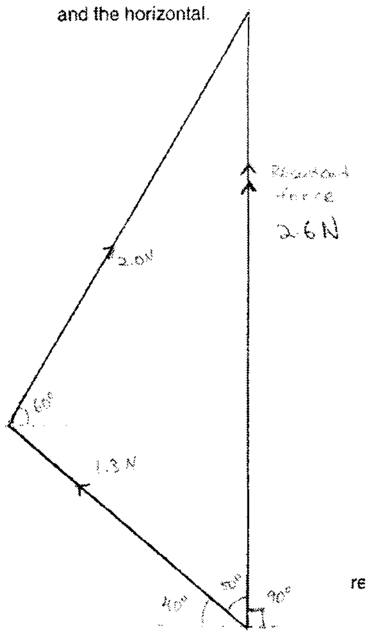
CHIJ SECONDARY (TOA PAYOH)
PRELIMINARY EXAMINATION 2025
SECONDARY 4(EXPRESS)

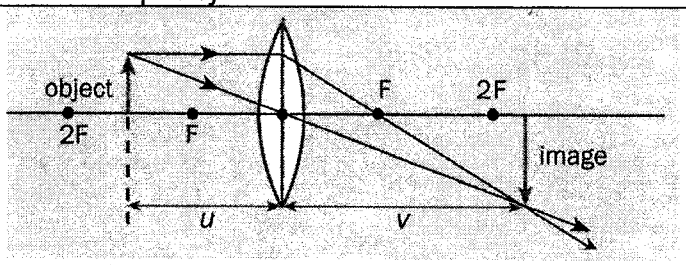
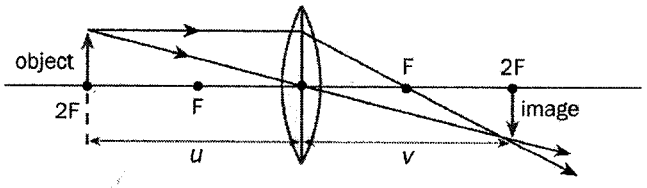
PHYSICS
6091/01
Paper 1

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

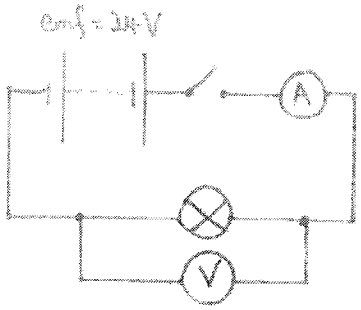
Paper 2
6091/02

Qn	Answers	Mark	
1(a)	 - Correct curve - Horizontal straight line towards t_2	 1 1	
1(b)	A gravitational field is a region where a mass experiences a force due to gravity (gravitational attraction).	1	
1(c)(i)	W = mg W = 65 x 3.0 = 195 N	1	
1(c)(ii)	Resultant force = 500 – 195 = 305 N	1	
1(c)(iii)	F = ma 305 = 65 x a a = 4.69 m/s^2	1 1	

2(a)	 - Appropriate scale - Tension A = 1.3 N - Tension B = 2.0 N - Correct addition of vectors	1 1 1 1	
3(a)	KE = ½ mv^2 KE = ½ x 2000 x 35^2 KE = 1.23 MJ	1 1	
3(b)	KE at X + GPE at X = KE at Y KE at X = 1.23 MJ – [2000x10x50] KE at X = 225 kJ ½ mv^2 = 225 000 J ½ x 2000 x v^2 = 225 000 v = 15 m/s	1 1 1	
3(c)	KE at Y = KE at Z + GPE at Z + work done against friction 1.23 MJ = [1/2 x 2000 x 4.0^2] + [2000x10x20] + [friction x 40] friction = 20.2 kN	1 1	
4(a)	Atmospheric pressure + pressure due to cylinder = pressure of gas Pressure due to cylinder = Pressure of gas – Atmospheric pressure = 2.0 x 10^5 – 1.0 x10^5 = 1.0 x 10^5 Pa Pressure = force / area 1.0 x 10^5 = weight / 4.0 x 10^{-4} Weight = 40 N W = mg m = 40 / 10 = 4 kg	1 1 1	
4(b)(i)	- Pressure of gas decreases. / AP decreases. - Volume of gas increases, piston will move upwards.	1 1	
5(a)	4200 J of energy is required for 1 kg of water to change its temperature by 1 °C.	1	
5(b)	Let the time be t energy lost = energy gained power x time = $m_1c\theta + m_2l_v$ 2500 x t = [1.50 x 4200 x (100 – 27)] + [0.50 x 2260 000] t = 636 s or 10.6 minutes	 1 1 1	

5(c)(i)	- During evaporation, the faster moving particles at the surface have enough energy to break away from the other liquid particles to escape into the air. - The remaining particles left behind have a slightly lower average speed. As temperature decreases with the average kinetic energy of the particles, water is slightly cooler.	1 1	
5(c)(ii)	- Internal kinetic energy remains the same - Internal potential energy is increased	1 1	
6(a)	x-rays, ultraviolet, infrared, microwaves 1 marks for every 2 correct positions	 2	
6(b)	Any 2: - Remote control for electrical appliances - Data transfer between devices such as mobile phones and laptops - Camera auto-focusing function - Contactless Thermometers - Intruders alarm	2	
6(c)	Any 1: - All obey the wave equation, $v = f\lambda$ - All travel at 3×10^8 m/s in vacuum - All transfer energy - All undergo reflections and refractions - All are transverse	 1	
7(a)	speed OR wavelength	1	
7(b)	frequency	1	
7(c)	 - Object placed between F and 2F away from lens Correct pair of rays drawn	 1 1	
7(d)	 - Object placed exactly at 2F away from lens Correct pair of rays drawn	 1 1	
8(a)(i)	If carbon brushes touch both halves of the split-ring, the circuit will be short-circuited. There will be no current flowing into the coil.	1	
8(c)(ii)	Motor will not start if the initial positions of both halves of the split-rings are not touching any of the carbon brushes. OR The coil is not connected to the circuit even if the switch is closed.	1	
8(b)(i)	downwards	1	
8(b)(ii)	- When current flows through the coil along AB and CD, a circular magnetic field forms around the current carrying conductor. - This circular magnetic field interacts with the magnetic field between the poles to produce a resultant force along AB and CD.	1 1	

8(c)(i)	Maximum moment = 2 x [force x perpendicular distance of force from pivot] Maximum moment = 2 x [5.0 x 0.070/2] = 0.35 Nm	1 1	
8(c)(ii)	When the coil is horizontal, the perpendicular distance of the force from the pivot is maximum.	1	
9(a)(i)	As wavelength increases, speed of the wave also increases.	1	
9(a)(ii)	In deeper water, speed of wave can increase up to 30.6 m/s but in shallower water, maximum speed of wave is only 9.9 m/s.	1	
9(b)(i)	speed = 30.6 m/s (from table) speed = distance/time 30.6 = 2000 000/time time = 18.2 hours	1 1	
9(b)(ii)	$v = f\lambda$ 30.6 = f x 600 f = 0.051 Hz	1 1	
9(b)(iii)	time taken = 4 + 18.2 = 22.2 hours speed = distance/time = 2000 000/[22.2x60x60] = 25.0 m/s From the table, wavelength is 400 m	1 1	
9(b)(iv)	1. As the first wave hits the ship, the ship will move up and down once returning back to its original position after the first wave leaves. 2. As frequency of the wave is increased, the ship will move up and down more over a same period of time.	1 1	
10(a)	Geiger-Muller counter OR GM counter	1	
10(b)	A β particle is a fast-moving electron ejected from a radioactive nucleus.	1	
10(c)	When a full carton of juice goes past the detector, the juice will absorb some of the β particles.	1	
10(d)	Source emitting alpha particles is not used because alpha particles cannot penetrate through the carton. No alpha particles will be detected at detector. OR Alpha particles are highly ionizing. They will cause mutation of cells in the juice. Source emitting gamma radiation is not used because gamma radiation can have ionizing effect on the juice, causing the juice to spoil. OR Gamma rays have high penetration power. Radiation received at the detector will be almost the same regardless of the juice level in carton.	1 1	
10(e)(i)	220 – 86 = 134 neutrons	1	
10(e)(ii)	$^{220}_{86}\text{Rn} \rightarrow {}^{216}_{84}\text{Po} + {}^{4}_{2}\alpha$	1 1	
10(f)(i)	The half-life of a radioactive nuclide is the time taken for half the nuclei of that nuclide in any sample to decay.	1	
10(f)(ii)	$7.68 \times 10^{12} \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ \times ½ = 3 \times 10^{10}$ Total = 8 half-life = 8 x 1.5 minutes = 12 minutes	1 1	
11(a)	- Circuit diagram showing power supply, lamp and ammeter in series - Voltmeter across lamp - Ensure voltage is 24 V in some way e.g. power supply 24 V - Power = voltmeter reading x ammeter reading	1 1 1 1	

			
11(b)(i)	Current at P = V / R = 240 / 380 = 0.632 A Current at Q = 0.632 + [240/190] = 1.89 A	1 1	
11(b)(ii)	Effective resistance of A and B = 1/ [1/190 + 1/380] = 127 Ω	1 1	
11(c)	- When one lamp blows, it will not affect the others - Same correct voltage 240 V is applied to all lamps when in parallel.	1 1	
12(a)	- Set metal sheet swinging freely **and** come to rest - Use of plumbline from hole - Trace plumbline onto sheet - Repeat from another hole and line intersection is centre of gravity	1 1 1 1	
12(b)	Distance measured = 2.5 cm (1 dp) Moment = force x perpendicular distance of force from pivot Moment = 0.10 N x 2.5 cm = 0.25 Ncm	1 1 1	
12(c)(i)	Due to the clockwise turning effect of its weight	1	
12(d)(ii)	Weight acting within its base area	1	
12(d)(iii)	Thicker more stable	1	
	END OF PAPER 2		