



TANJONG KATONG SECONDARY SCHOOL
Preliminary Examination 2024
Secondary 4

NAME

CLASS

 Index Number

PHYSICS

6091/01

Paper 1 Multiple Choice

23 August 2024
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

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

My Predicted Grade

Before doing assessment:	After doing assessment:

This document consists of **21** printed pages and **3** blank pages.

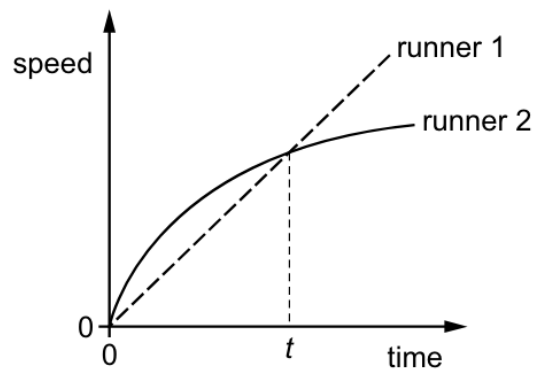
- 1 When a force F moves its point of application through a displacement d in the direction of the force, the work W done by the force is given by

$$W = F \times d$$

How many vector quantities and scalar quantities does this equation contain?

- A three scalar quantities
 - B three vector quantities
 - C one scalar quantity and two vector quantities
 - D one vector quantity and two scalar quantities
- 2 Two runners take part in a race.

The graph shows how the speed of each runner changes with time.

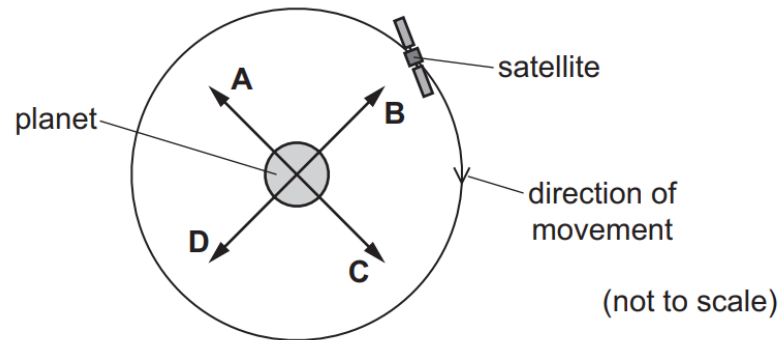


What does the graph show about the runners at time t ?

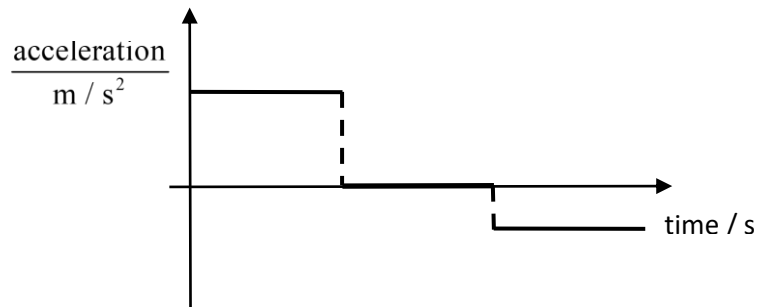
- A Runner 1 has zero acceleration.
- B Runner 1 runs ahead of runner 2.
- C Runner 2 is slowing down.
- D Both runners are moving at the same speed.

- 3 A satellite orbits a planet in a circular path as shown. The satellite experiences a gravitational force due to the planet.

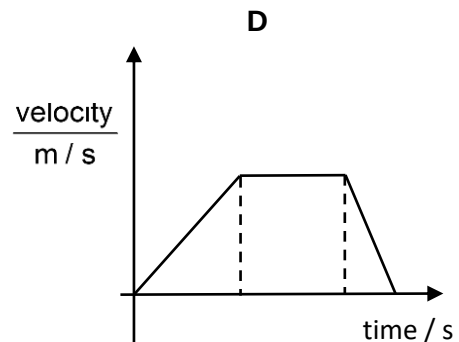
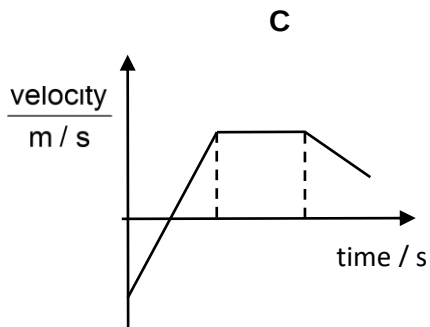
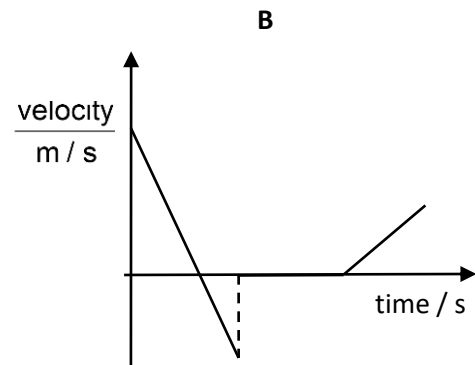
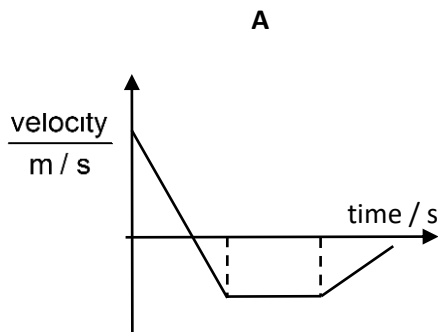
In which direction is the force on the planet due to the satellite?



- 4 A car travels according to the acceleration-time graph as shown below.



Which velocity-time graph best describes the motion of the car?



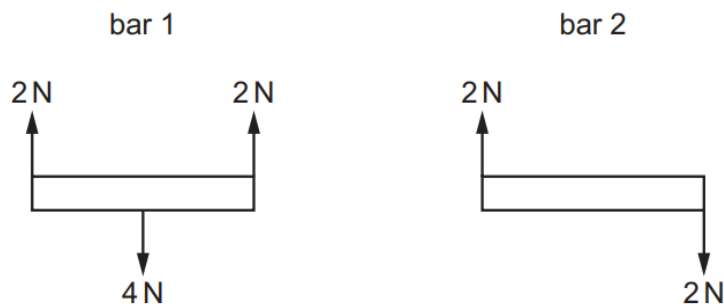
- 5 A cyclist is travelling in a straight line along a horizontal road at a constant speed. A constant driving force F acts on the cyclist in the forward direction shown.



Which statement about the magnitude of the frictional forces acting on the cyclist is correct?

- A The magnitude is smaller than F , but greater than zero.
 - B The magnitude is greater than F .
 - C The magnitude is equal to F .
 - D The magnitude is zero.
- 6 The diagram shows two identical bars of negligible weight.

All the forces acting on each bar are marked.



Which bars are in equilibrium?

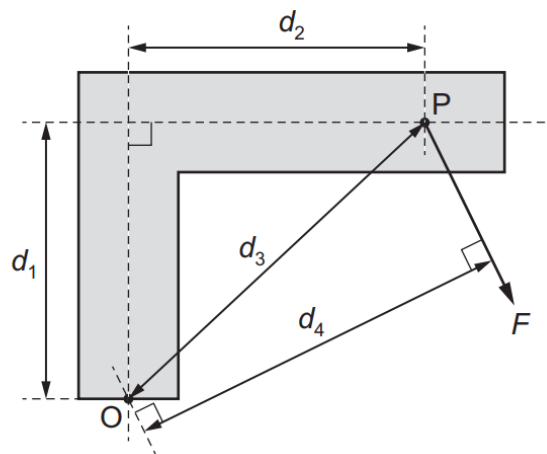
- A bar 1 only
- B bar 2 only
- C bar 1 and bar 2
- D neither bar 1 nor bar 2

7 An electron has mass. Where does a stationary electron experience a force?

- A in an electric field only
- B in a gravitational field only
- C in a gravitational field and an electric field only
- D in a gravitational, electric and magnetic field

8 A force F causes a moment about point O on an L-shaped bar.

The force F acts at point P.



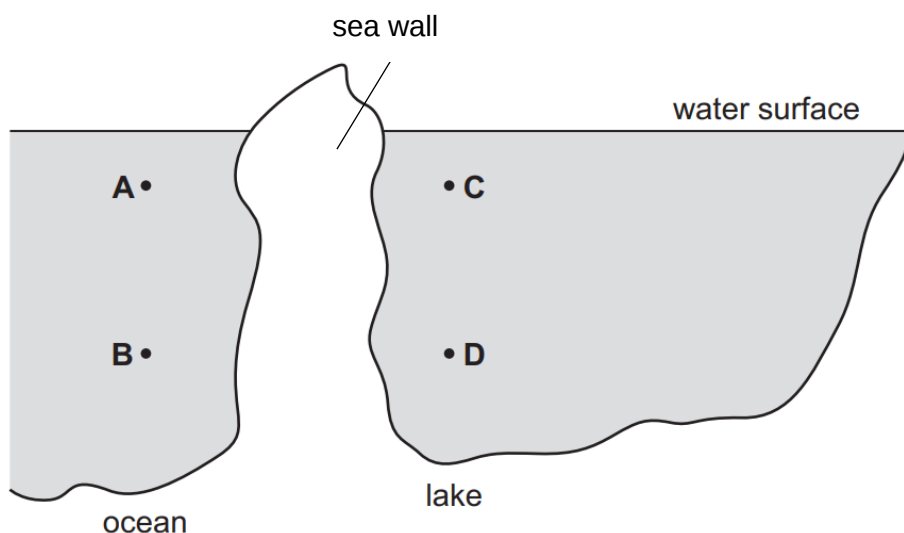
What is the moment of F about O?

- A Fd_1
- B Fd_2
- C Fd_3
- D Fd_4

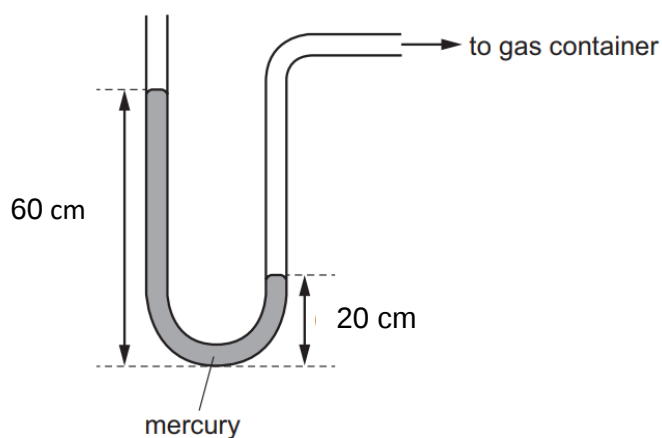
- 9 An underwater diver experiences varying pressure when he dives in different bodies of water.

The density of water in the lake is less than in the ocean.

In which position does the diver experience the smallest pressure due to the water?



- 10 The diagram shows a mercury manometer connected to a gas container.



The density of mercury is $14\,000\text{ kg / m}^3$.

The gravitational field strength g is 10 N / kg .

What is the pressure difference between the gas in the container and the atmosphere?

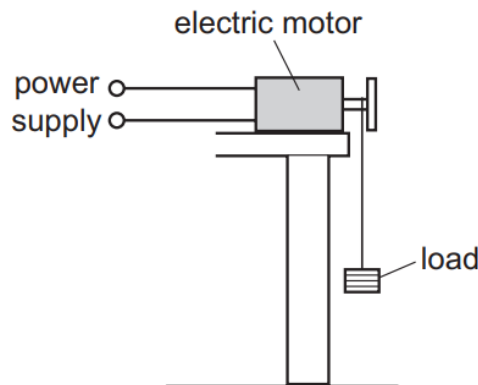
- A 28 000 Pa
- B 42 000 Pa
- C 56 000 Pa
- D 84 000 Pa

- 11** A bicycle braking system transfers energy from a kinetic store to an internal store. A motor transfers energy from a chemical store to a kinetic energy store.

What is the energy pathway used in each of the energy transfer?

	braking system	motor
A	electrical	mechanical
B	electrical	electrical
C	mechanical	mechanical
D	mechanical	electrical

- 12** An electric motor is used to lift a load at a constant speed.



The energy transferred to the gravitational potential store in the load increases. The moving load also has energy in the kinetic store.

Which expression is used to calculate the efficiency of the motor when the load is being lifted at a constant rate?

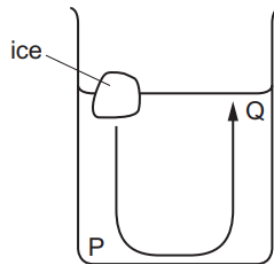
- A** $\text{efficiency} = \frac{\text{energy transferred per second to gravitational potential store of load}}{\text{energy transferred per second to kinetic store of load}}$
- B** $\text{efficiency} = \frac{\text{energy transferred per second to gravitational potential store of load}}{\text{power supplied}}$
- C** $\text{efficiency} = \frac{\text{power supplied}}{\text{energy transferred per second to gravitational potential store of load}}$
- D** $\text{efficiency} = \frac{\text{power supplied}}{\text{energy transferred per second to kinetic store of load}}$

- 13** A box with mass 4.0 kg is pulled from rest along a horizontal floor by a constant force F . A constant frictional force of 1.0 N acts on the box.

When the box has travelled 0.90 m , its velocity is 1.5 m / s .

What is force F ?

- A** 3.6 N
- B** 4.5 N
- C** 5.0 N
- D** 6.0 N
- 14** The diagram shows a convection current caused by a piece of ice placed in a beaker of water at room temperature.



Which row correctly compares the temperatures and densities at water points P and Q?

	temperature at P	density at P
A	higher than at Q	higher than at Q
B	higher than at Q	lower than at Q
C	lower than at Q	higher than at Q
D	lower than at Q	lower than at Q

- 15** The outside of one of two identical shiny metal containers is painted dull black. The containers are filled with equal masses of hot water at the same temperature.

Why does the dull black container cool more quickly?

- A** Black surfaces are better conductors than shiny surfaces.
- B** Black surfaces are better emitters of radiation than shiny surfaces.
- C** Black surfaces are better reflectors of radiation than shiny surfaces.
- D** Black surfaces are worse absorbers of radiation than shiny surfaces.

- 16** A student on a camping expedition cools a sealed bottle of water which is at the same temperature as the surrounding air.

Which method cools the water at the greatest rate?

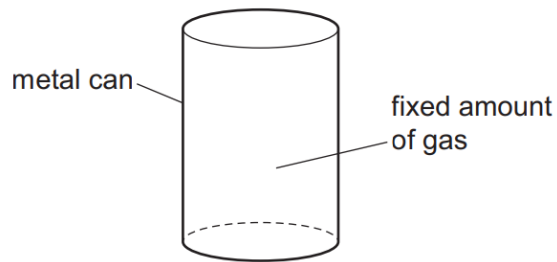
- A** Wrap the bottle in aluminium foil and place it in a shady place.
- B** Wrap the bottle in dry, white paper and put it in a sunny place.
- C** Wrap the bottle in foam and put it in a breeze.
- D** Wrap the bottle in wet paper and put it in a breeze.

- 17** Small pollen particles are suspended in water. When viewed with a microscope, the pollen particles can be seen to be moving about irregularly.

What causes this movement?

- A** The temperature of the water is higher than that of the pollen particles.
- B** The temperature of the water is lower than that of the pollen particles.
- C** The pollen particles are being bombarded by the heavier particles of the water.
- D** The pollen particles are being bombarded by the lighter particles of the water.

- 18** A fixed amount of gas is trapped inside a metal can.



The temperature of the gas decreases but the volume does not change.

How does this change affect the kinetic energy of the gas molecules and the pressure inside the metal can?

	kinetic energy	pressure
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	stays the same	decreases

- 19** Using an electric kettle, 100 g of water at 100 °C is converted into steam at 100 °C in 300 seconds.

The specific latent heat of steam is 2250 000 J / kg.

What is the average electrical power used?

A
$$\frac{100 \times 2250\,000}{300}$$

B
$$\frac{100 \times 2250\,000}{300 \times 1000}$$

C
$$\frac{300 \times 2250\,000}{100}$$

D
$$\frac{2250\,000 \times 1000}{300 \times 100}$$

- 20** Solar panels are used to heat water with a mass of 500 kg.

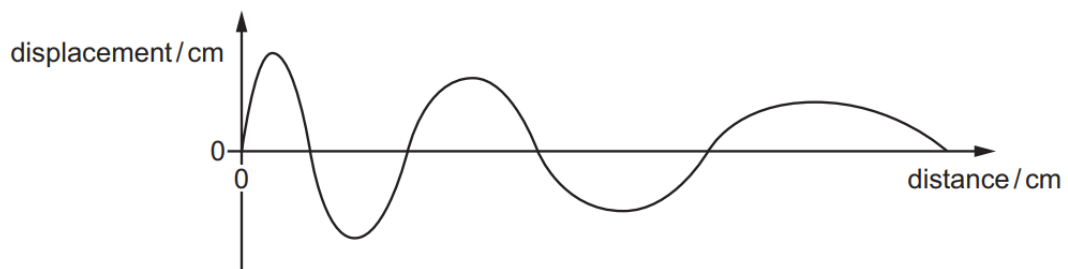
The total area of the solar panels is 10 m^2 and the average power output from each square metre of the panels is 300 W.

The specific heat capacity of water is $4200 \text{ J / (kg } ^\circ\text{C)}$.

What is the increase in the water temperature after 8.0 hours?
(Assume there is no energy loss.)

- A** $0.69 \text{ } ^\circ\text{C}$
- B** $4.1 \text{ } ^\circ\text{C}$
- C** $5.1 \text{ } ^\circ\text{C}$
- D** $41 \text{ } ^\circ\text{C}$

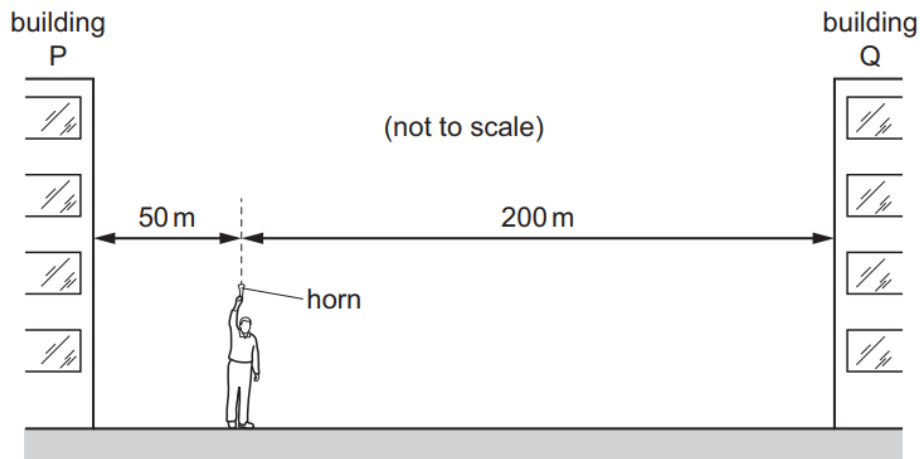
- 21** A wave has the appearance shown.



How do the properties of the wave change as the distance from the origin increases?

	amplitude	frequency
A	decreases	increases
B	decreases	decreases
C	increases	increases
D	increases	decreases

- 22 A man stands between two tall buildings, P and Q. He is 50 m from P and 200 m from Q.



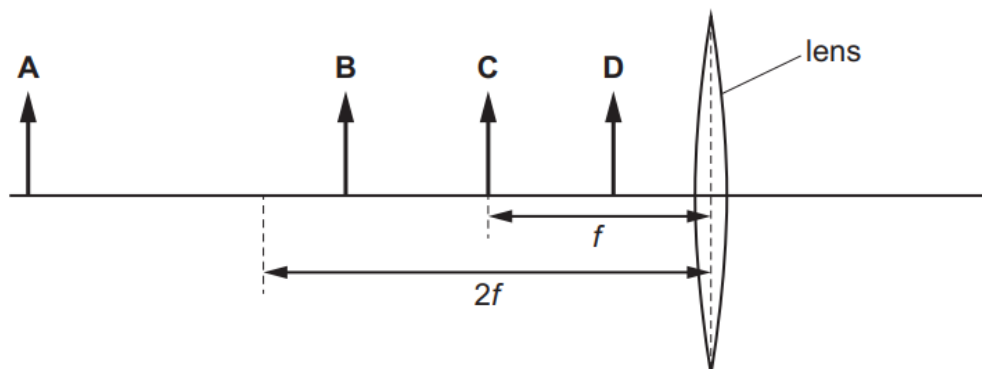
He sounds a horn.

He hears the first echo from building P and 1.0 s later he hears the first echo from building Q.

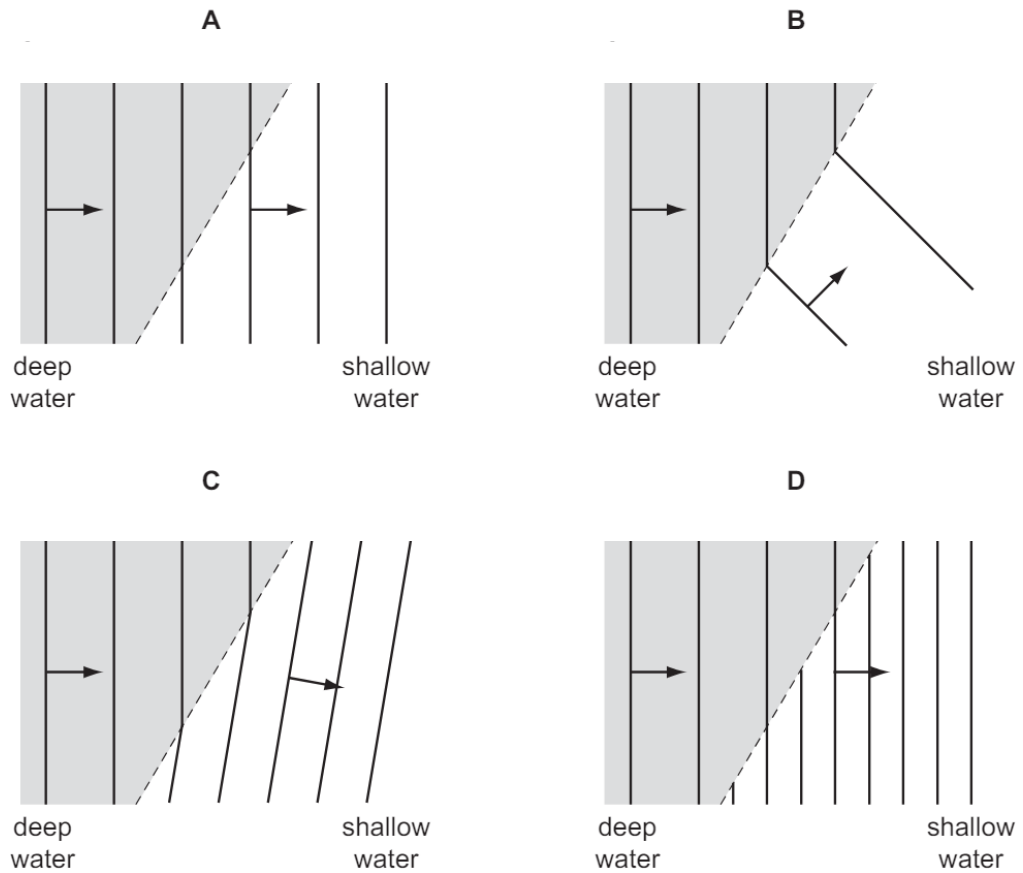
What is the speed of sound calculated using this information?

- A 250 m / s
 - B 300 m / s
 - C 330 m / s
 - D 500 m / s
- 23 An object is placed in front of a converging lens. The lens has a focal length f .

In which labelled position should the object be placed in order to produce a real image that is smaller than the object?

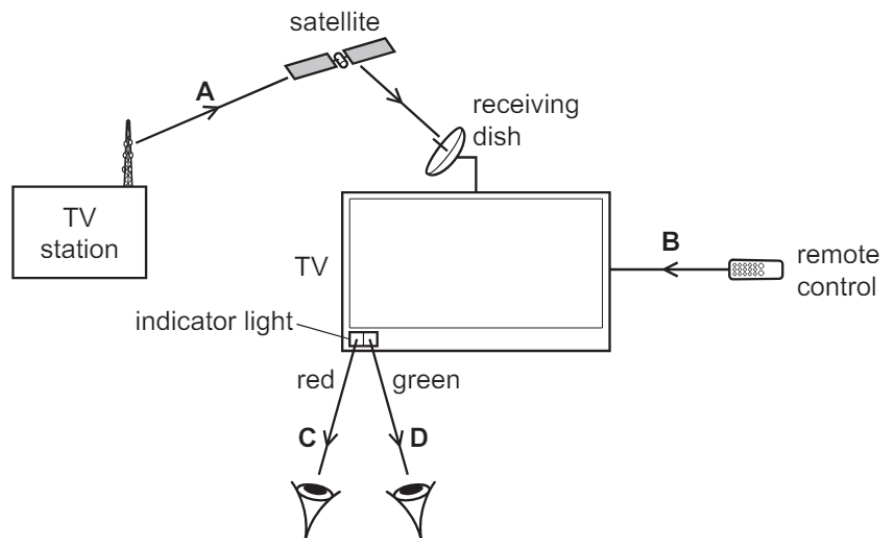


- 24 A ripple tank is used to demonstrate refraction of plane water waves. Which diagram shows what happens to the waves?

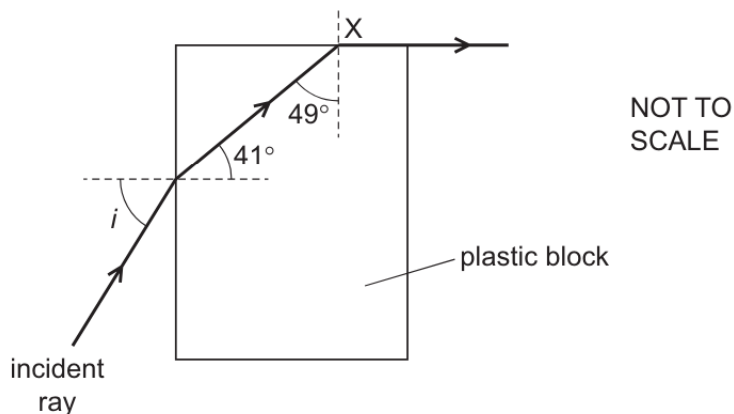


- 25 A television (TV) station transmits a signal to a television receiving dish. The television has an on / off indicator light. The television is switched on by a remote control which changes the indicator light from red to green.

Which electromagnetic wave used in these actions has the longest wavelength?

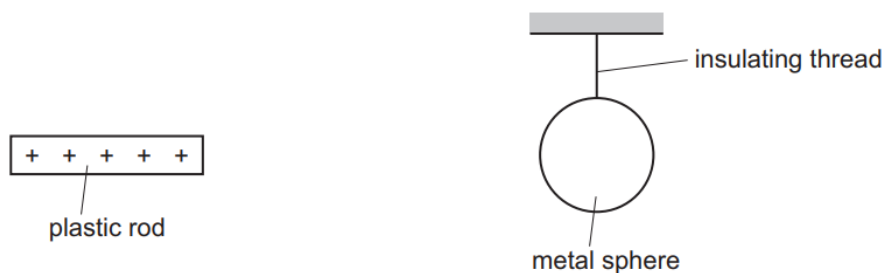


- 26 A ray of light is incident on a plastic block in air, at an angle of incidence i . The refractive index of the plastic is n . The light ray refracts along the plastic-air boundary when it reaches X.



Which equation is correct?

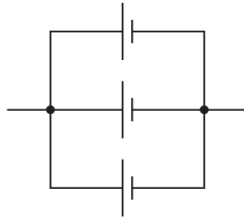
- A $\sin i = \frac{\sin 41^\circ}{n}$
- B $\sin i = \frac{n}{\sin 49^\circ}$
- C $\sin i = n \times \sin 41^\circ$
- D $\sin i = n \times \sin 49^\circ$
- 27 The diagram shows a charged plastic rod and an uncharged metal sphere. The metal sphere is suspended by an insulating thread. The plastic rod is then moved close to the metal sphere.



Which row is correct?

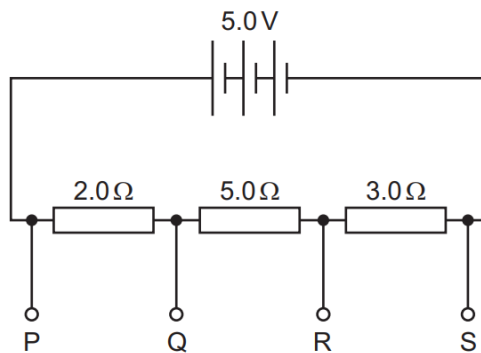
	observation	the overall state of the metal sphere
A	The rod attracts the sphere.	charged
B	The rod attracts the sphere	uncharged
C	The rod repels the sphere.	charged
D	The rod repels the sphere.	uncharged

- 28 The diagram shows a battery of three 1.5 V cells.



What is an advantage of this arrangement of cells?

- A The e.m.f. of the battery is 4.5 V.
 - B The battery can supply any e.m.f. between 0 V and 4.5 V.
 - C The battery can supply a current for a longer time than a single 1.5 V cell.
 - D The battery supplies more energy to each coulomb of charge than a single 1.5 V cell.
- 29 The diagram shows a circuit with a 5.0 V power supply, three resistors and four output terminals P, Q, R and S.



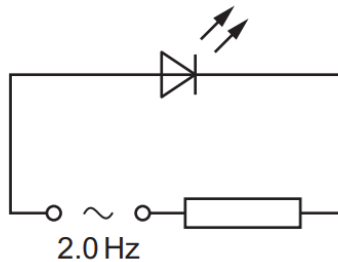
Between which pair of terminals is there a potential difference of 1.5 V?

- A PQ
- B PR
- C QS
- D RS

- 30** Two identical resistors are connected first in series and then in parallel. The two resistors in series are connected to a power supply and the current is I_s . The parallel combination is connected to the same power supply and the current supplied is I_p .

What is the ratio of $\frac{I_s}{I_p}$?

- A** 0.25
B 0.50
C 2.0
D 4.0
- 31** The diagram shows an LED connected in a circuit with a resistor and an alternating current power supply of frequency 2.0 Hz.



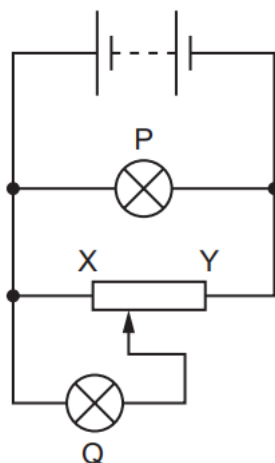
Which statement is correct?

- A** The LED does not light.
B The LED flashes on twice each second and off twice each second.
C The LED flashes on four times each second and off four times each second.
D The LED stays on all the time.
- 32** A car battery delivers 150 kC to a circuit before it needs recharging. Two headlamps connected in parallel to the battery are switched on. There is a current of 4.0 A in each lamp.

How much time passes before the battery needs recharging?

- A** 2.6 hours
B 5.2 hours
C 7.8 hours
D 10.4 hours

- 33** The diagram shows a battery connected to a potential divider and to two lamps, P and Q.



The slider on the potential divider is moved from end X to end Y of the resistor. Which row shows the effect on the brightness of each lamp?

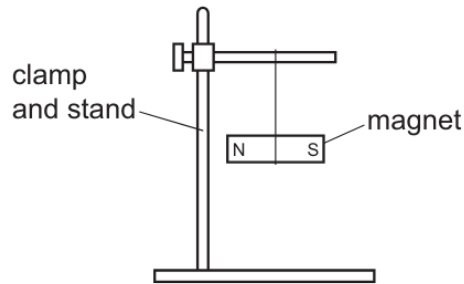
	brightness of P	brightness of Q
A	brighter	brighter
B	brighter	dimmer
C	unchanged	brighter
D	unchanged	dimmer

- 34** The cost of electricity is 9.0 cents per kWh. It takes 0.060 hours and costs 1.2 cents to boil the water in a kettle.

What is the power rating of the kettle?

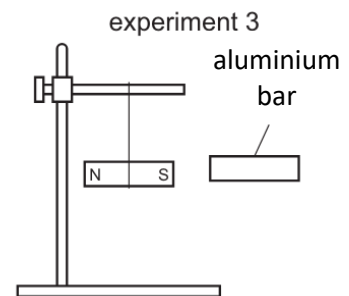
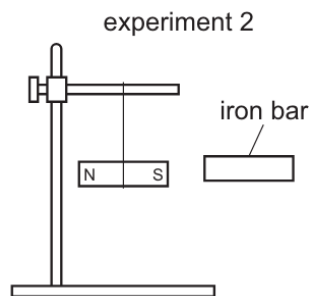
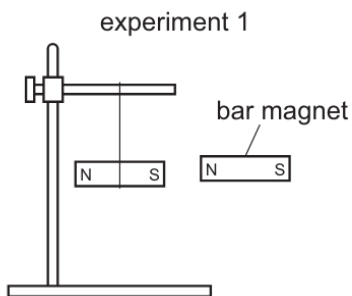
- A** 0.45 kW
- B** 0.65 kW
- C** 2.2 kW
- D** 130 kW

- 35 A student uses a wooden clamp and a stand to hold a freely suspended bar magnet.



The diagrams show that:

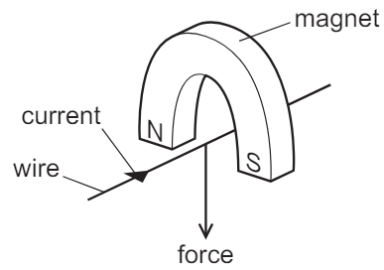
- in experiment 1, the student holds a bar magnet next to the suspended magnet,
- in experiment 2, the student holds an iron bar next to the suspended magnet,
- in experiment 3, the student holds a aluminium bar next to the suspended magnet.



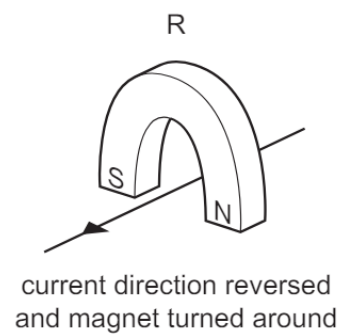
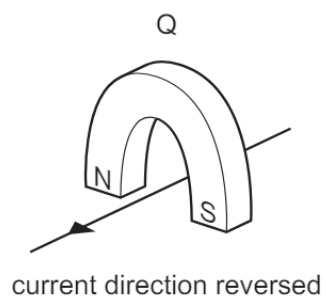
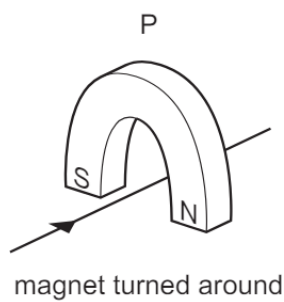
In which experiment(s) does the suspended magnet move?

- A** 1 only.
- B** 1 and 2 only.
- C** 1 and 3 only.
- D** 1, 2 and 3

- 36** A wire is placed between the poles of a horseshoe magnet. There is a current in the wire in the direction shown, and this causes a force to act on the wire.



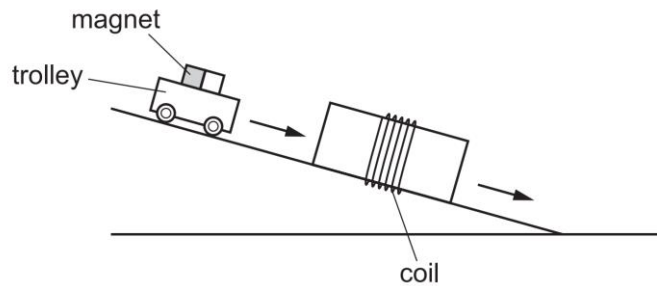
Three other arrangements, P, Q and R, of the wire and magnet are set up as shown.



Which arrangement or arrangements will cause a force in the same direction as the original arrangement?

- A** P, Q and R
- B** P and Q only
- C** P only
- D** R only

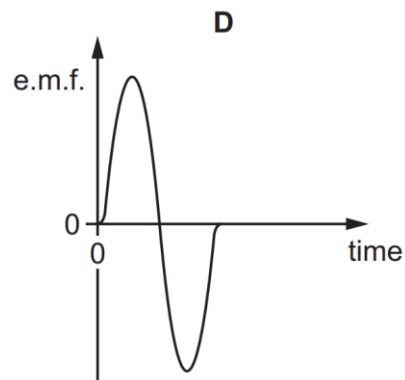
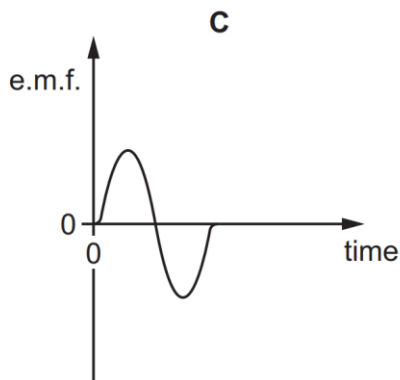
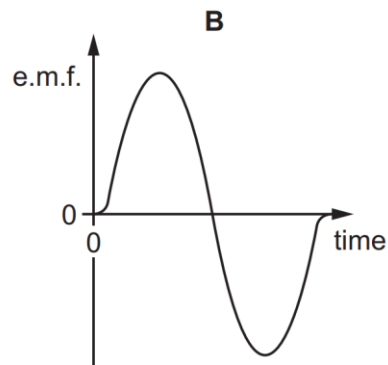
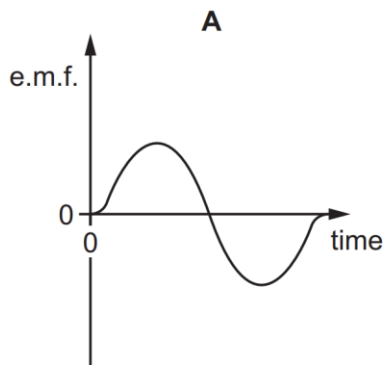
- 37 A trolley carrying a strong magnet rolls down a ramp at constant speed. It passes through a coil as shown.



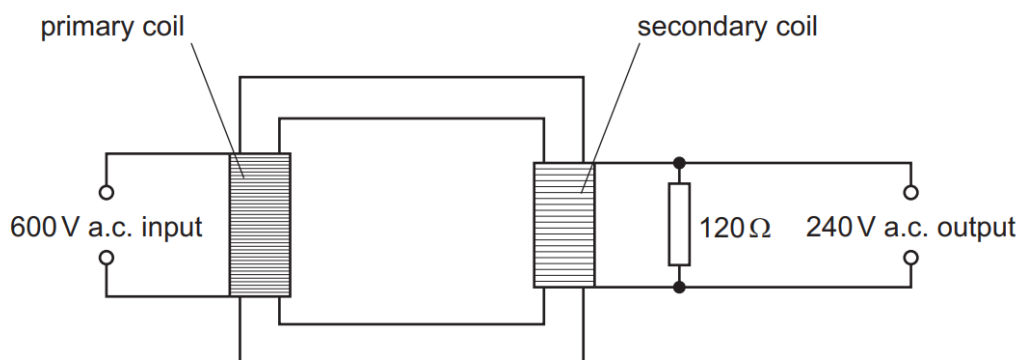
An electromotive force (e.m.f.) is induced in the coil. A graph of the e.m.f. against time is plotted.

The experiment is repeated with a steeper ramp. The trolley moves at a greater constant speed on the steeper ramp.

Which graph is produced using the coil with steepest ramp?
All graphs are drawn to the same scale.



- 38** A transformer with an efficiency of 100% has a primary voltage input of 600V and a secondary voltage output of 240V. The secondary coil is attached to a resistor of resistance $120\ \Omega$.



What is the power and current in the primary coil?

	power / W	current / A
A	120	0.20
B	120	5.0
C	480	0.80
D	480	1.3

- 39** Technetium-99m is a radioactive isotope used in medical scanning. It is injected into the body and its emissions are detected outside the body. Which characteristics of technetium-99m make it suitable for use in medical scanning?

- A** It has a long half-life and emits alpha radiation.
- B** It has a long half-life and emits gamma radiation.
- C** It has a short half-life and emits alpha radiation.
- D** It has a short half-life and emits gamma radiation.

- 40** In a fission reactor, which particle causes a uranium-235 nucleus to split?

- A** alpha-particle
- B** gamma ray
- C** neutron
- D** proton

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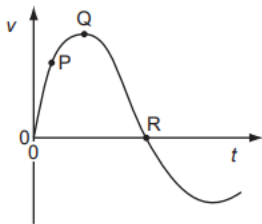
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Extra questions

Preliminary Examinations Paper 1

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

7 The graph shows how velocity v varies with time t for a bungee jumper.



At which point is the bungee jumper momentarily at rest and at which point does she have zero acceleration? n it. It has a forward

	jumper at rest	jumper with zero acceleration
A	Q	P
B	Q	R
C	R	Q
D	R	R

► driving force

- A 0.50 kN
- B 1.5 kN
- C 2.0 kN
- D 3.5 kN

