BUKIT PANJANG GOVERNMENT HIGH SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY 4 EXPRESS

PHYSICS
Paper 1

6091 / 01

Date: 31 August, 2021
Duration: 1 hour
Time**: 0745-0845**

Additional Materials: OAS

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 OAS in the spaces provided.

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

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 scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE	
Total:	/ 40

Setter: Ms. Le Nam Chi

[Turn over

1   The angular momentum of an object in a circular orbit can be calculated using the formula:

Angular momentum = mass x velocity x radius of orbit

What is the derived SI unit of angular momentum?

A kgm^{-2} **B** kgm^2s^{-1}
C $kgms^2$ **D** $kgms^{-2}$

2   A stone is dropped from a tall building. 5 seconds later, an identical stone is dropped from the same height. Which of the following statements is correct about the motion of the two stones before they hit the ground? Assume air resistance is negligible.

A   The distance between the stones will remain constant throughout.
B   The distance between the stones will increase with time.
C   The distance between the stones will decrease with time then remain constant.
D   The distance between the stone will decrease with time.

3   Which of the following diagram represents the velocity-time graph of an object when a constant force is applied on it?

4   A block accelerates at 1.7 ms^{-2} from a height of 0.21 m down a smooth plank from rest. The plank is inclined at an angle of 10° to the horizontal. What is the speed of the block at the bottom of the plank?
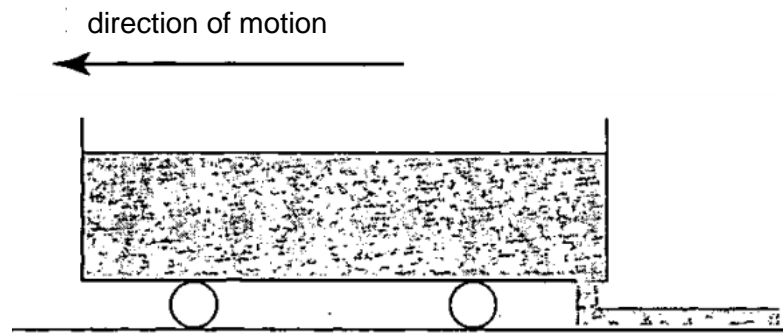
block

0.21 m

10°
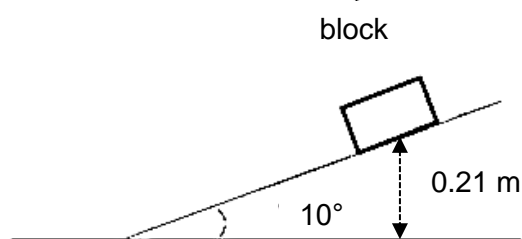
A   0.83 ms^{-1}
B   2.0 ms^{-1}
C   4.8 ms^{-1}
D   14 ms^{-1}

5   To pull a tree stump out of the ground, two tractors pull on ropes in different directions. The diagram, not drawn to scale, shows the view from the top.

1000 N

1500 N
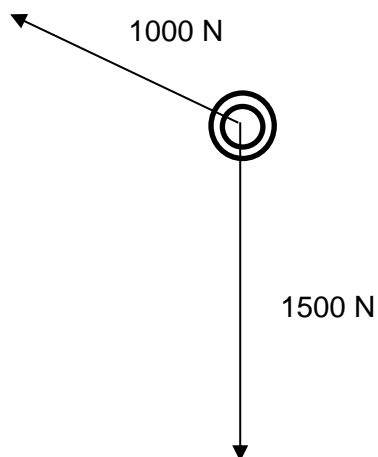
Which of the following options shows the most likely resultant force?

A   B   C   D
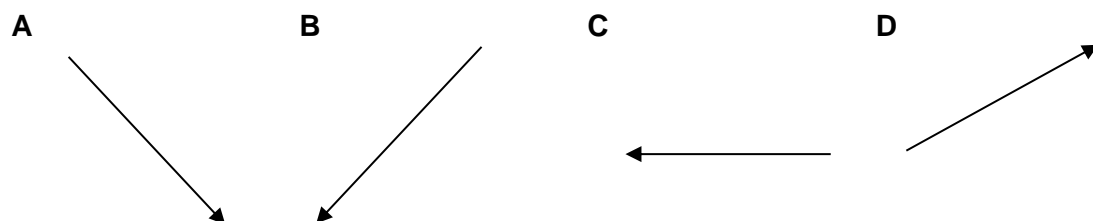
6   The diagram below shows a train car that is loaded with sand.

direction of motion

It is moving at a constant speed along a smooth horizontal track with negligible friction. A hole develops in the bottom of the car and sand starts spilling out onto the ground at a constant rate. While the sand is spilling out, how does the speed of the car change? Ignore air resistance.

A   It decreases uniformly.
B   It increases uniformly.
C   It increases at an increasing rate.
D   It stays the same.

7   A brick is placed on a table top. A force F is applied on it such that the brick moves with a constant speed, as shown in the diagram below.

motion

F
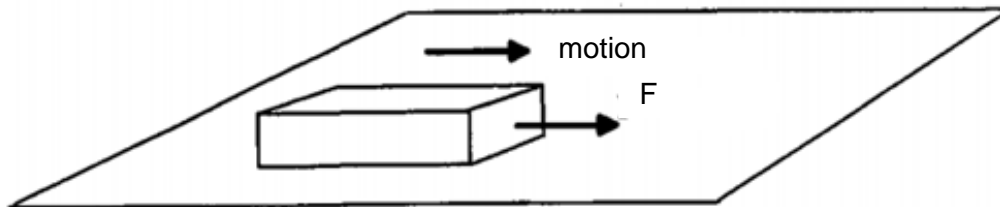
How will the speed of the brick change immediately after the force F is removed?

A   It will decrease.
B   It will increase.
C   It will be the same.
D   There is not enough information to form a conclusion.

8 Min Min pushes a thick Physics book against the ceiling using a force F of 30 N. The book has a weight of 20 N.

ceiling

Physics book

F
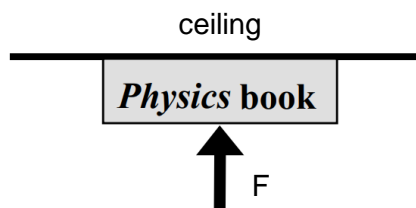
Which of the following options shows the correct value for each pair of contact forces?

	between ceiling and book	between hand and book
A	10 N	50 N
B	10 N	30 N
C	20 N	30 N
D	30 N	10 N

9 The following four properties of a solid object are measured in a laboratory on the Earth's surface.

Which property would have a different value if measurements were carried out in a space laboratory?

A Density of the object
B Mass of the object
C Weight of the object
D Volume of the object

10 A rectangular, uniform signboard is attached to a vertical wall by a hinge at P so that Q rests against the wall vertically below P.

P

3 m

wall

2 m

signboard

F

Q
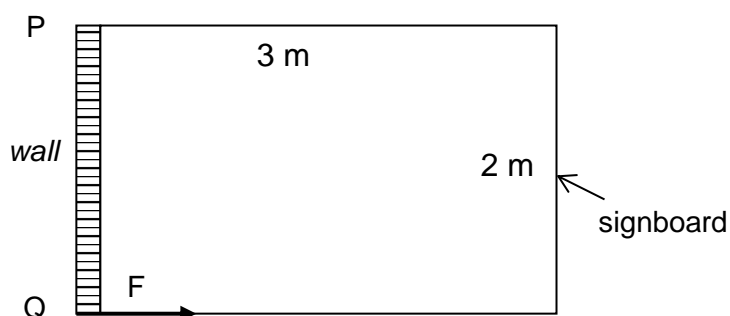
If the mass of the signboard is 60 kg, what is the normal reaction, F, exerted by the wall at Q?

A 200 N
B 400 N
C 450 N
D 900 N

11 A trolley of mass 50 kg runs from position P to Q along a rough track.
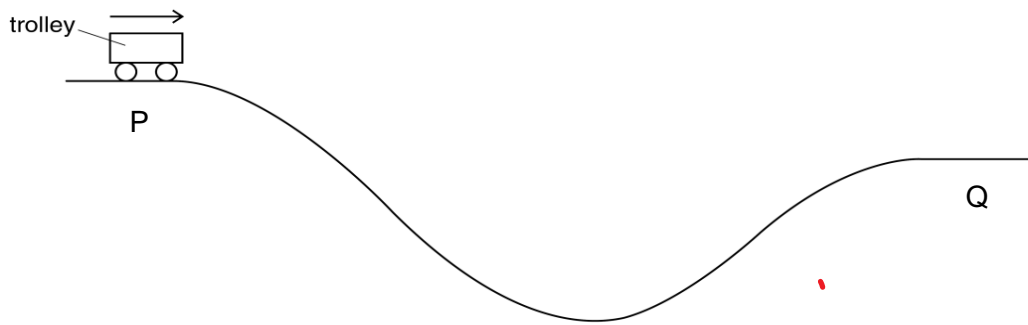
At point Q, its potential energy is 50 J less than at point P. Its speed at point P is 3.0 ms^{-1}. The work done against friction from point P to Q is 20 J.

What is the speed of the trolley at point Q?

A   1.1 ms^{-1}
B   1.4 ms^{-1}
C   3.0 ms^{-1}
D   3.2 ms^{-1}

12 Amin and Kumar start off at the same time to run up a hill. Amin is 50 kg while Kumar is 70 kg.
Which statement is true about the power produced?

A   Amin produced more power.
B   Kumar produced more power.
C   They produced the same power.
D   It is impossible to tell from the information provided.

13 In a hydraulic press, a small piston of weight 150 N is pushed down and this force is just sufficient to raise a heavy load in the large piston. Neglecting the weight of the pistons, what is the maximum load that can be lifted?
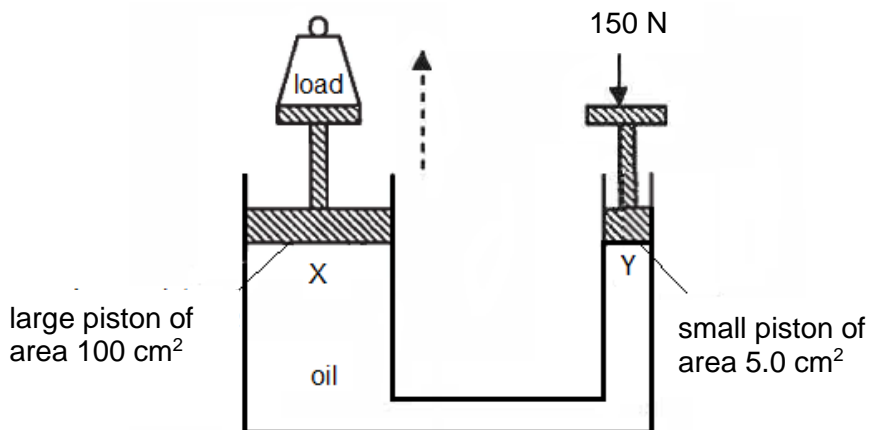

A   7.5 N   B   500 N   C   750 N   D   3000 N

14 A uniform capillary tube is closed at one end. It contains air trapped by a thread of mercury 80 mm long. When the tube is held horizontally, the length of the air column is 20 mm. When it is held vertically with the closed end downwards, the length is 18 mm.

Given that the atmospheric pressure is *p,* which of the following expression shows the pressure, in terms of *p,* exerted by the mercury column on the trapped air?

mercury

20 mm   80 mm

80 mm

18 mm
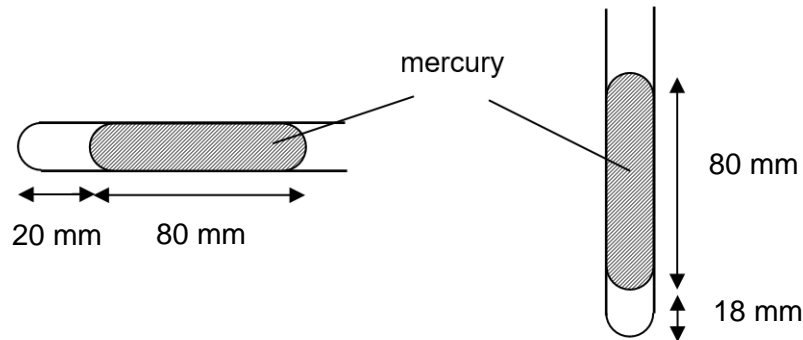
A $\dfrac{p}{10}$

B p

C $\dfrac{p}{9}$

D $p\text{-}80$

15 The mercury-in-glass thermometer in the diagram below has a linear scale.

h
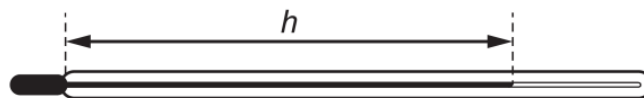
At a temperature of 100 °C, *h* has a value of 28 cm.
At 80 °C, *h* has a value of 24 cm.
What is the value of *h* when the temperature is 20 °C?

A   0.0 cm   B   4.0 cm   C   8.0 cm   D   12.0 cm

16 What does the temperature of a gas measure?

A   average velocity of the gas molecules
B   maximum velocity of the gas molecules
C   average kinetic energy of the gas molecules
D   total kinetic energy of the gas molecules

[Turn over

17 A fixed mass of gas is kept at constant volume. When the temperature of the gas increases, the pressure increases.

What is the reason for the increase in pressure?

A The gas molecules move more vigorously.
B The gas molecules are closer together.
C The gas molecules collide more frequently against one another.
D The gas molecules expands with temperature.

18 In very cold weather, ice can form on the surface of puddles of water because the air temperature is below that of the water.

If the ice layer is found to be thickening at its lower surface, what is the main method of thermal transfer that causes this?

A Convection through the water.
B Conduction through the air.
C Conduction from the lower to the upper surface of the ice.
D Conduction from the upper to the lower surface of the ice.

19 Different surfaces reflect different proportions of energy from the sun. The figure below shows the percentage of thermal energy which is reflected by some surfaces.

Percentage of thermal
energy reflected
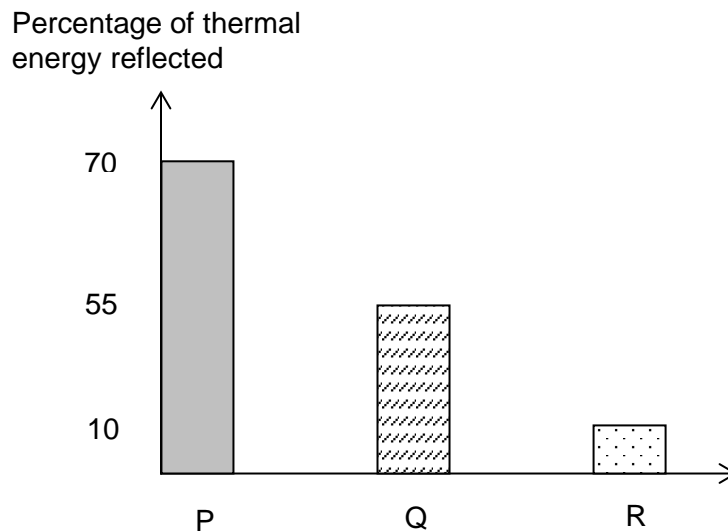
Which of the following best describes the type of surface?

	White washed	Red brick	Black tar
A	P	R	Q
B	Q	R	P
C	R	Q	P
D	P	Q	R

20 A cooking pot is used to cook porridge. It is found that the porridge can continue to boil for a long time after the pot is removed from the stove.

What could be a possible explanation?

A   The pot is made of a material with very high melting point.
B   The pot is made of a very good insulator.
C   The pot is made of a very good conductor.
D   The pot has very high heat capacity.

21 Hot water at 100 °C is added to 5.0 g of ice at 0 °C.
What is the minimum mass of hot water needed to melt the ice?

Specific latent heat of fusion of ice is 336 J g^{-1}.
Specific heat capacity of water is 4.2 J g^{-1} K^{-1}.

A   0.8 g
B   4.0 g
C   16.8 g
D   70.6 g

22 The refractive index of water and a particular type of glass is 1.33 and 1.45 respectively. Which of the following statements is correct about total internal reflection at the boundary between them?

A   It is impossible for total internal reflection to occur.
B   It can occur when light travels from glass to water.
C   It can occur when light travels from water to glass.
D   It can occur when light travels from water to glass and from glass to water.

23 An illuminated object is placed at distance $u = 400$ mm from a converging lens of focal length $f = 150$ mm. A screen is then positioned so that a sharp image of the object is seen on the screen.

If the object is moved 100 mm towards the lens, how must the screen be moved such that a sharp image can be obtained again? (The formula for thin lens is $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, where v is the distance of the image from the focal point of the lens.)

object

$u = 400$ mm v screen
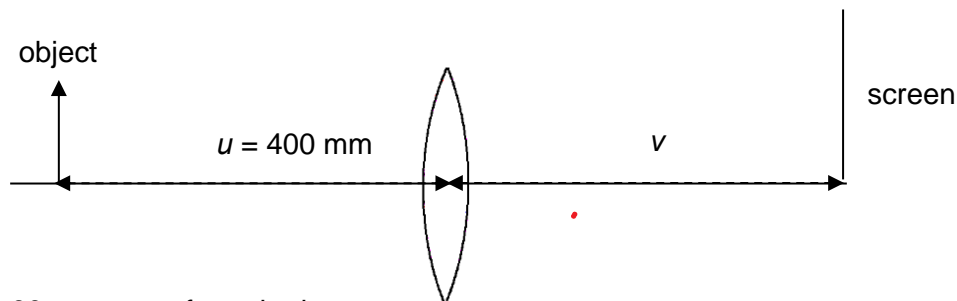
A   60 mm away from the lens.
B   60 mm towards the lens.
C   100 mm away from the lens.
D   100 mm towards the lens.

[Turn over

24 Which of the following application does not use electromagnetic wave?
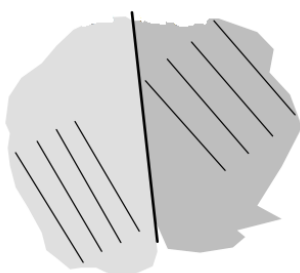
    A   sonar
    B   sun bed
    C   gamma knife radiosurgery
    D   remote controller

25 The diagram shows the wavefronts of a wave from an earthquake. The speed of propagation of the wave increases as it enters rock type 2 from rock type 1.
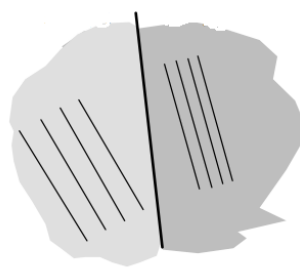

rock type 1   rock type 2
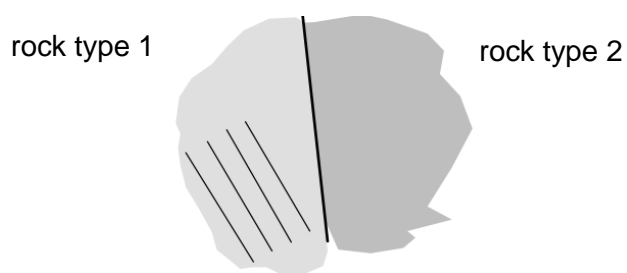
Which of the following figures correctly shows the path of the wavefronts as the wave travels from rock type 1 to rock type 2?

A

B

C
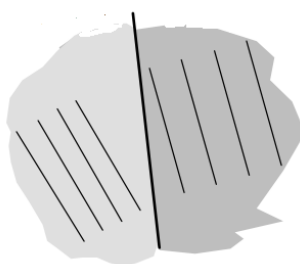
D
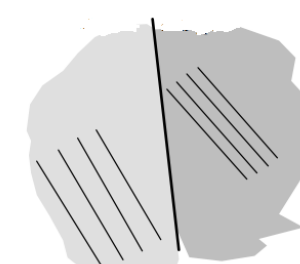
26 Which of the following summarises the change in wave characteristics from infra-red to gamma rays in the electromagnetic spectrum?

|	frequency	Speed (in vacuum)
A	decreases	decreases
B	increases	remains constant
C	decreases	remains constant
D	increases	increases

27 The distribution of electric field lines in a certain region of space varies as shown in the diagram below.
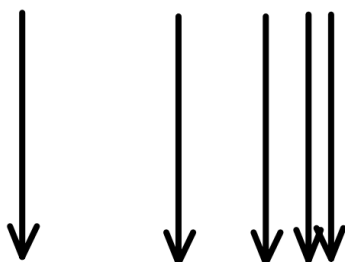
What can be concluded about the magnitude of the electric field strength?

A   It increases from left to right.
B   It decreases from left to right.
C   It increases from top to bottom.
D   It decreases from top to bottom.

28 Three initially uncharged spheres X, Y and Z are in contact, each supported on an insulating stand. A positively charged rod is placed close to but not touching X.
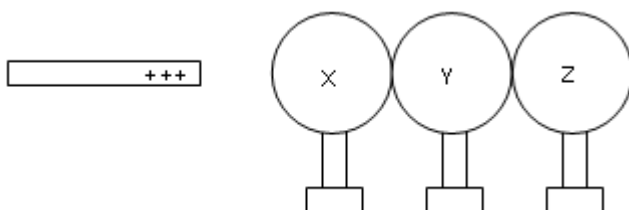
Which of the following best illustrates the distribution of charges on sphere Y?

A   B   C   D
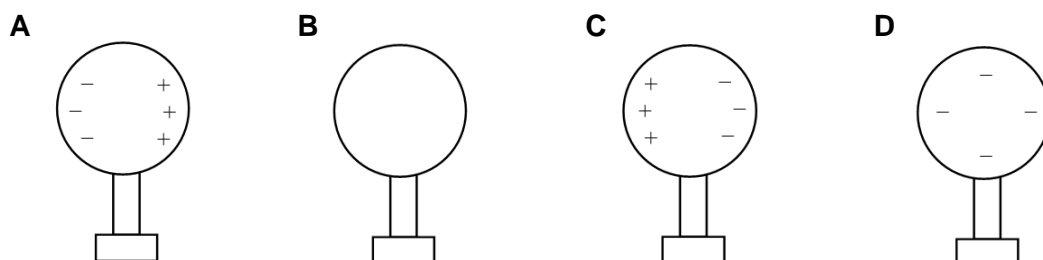
29 A negatively charged sphere stays stationary between two charged metal plates as shown below. If the potential difference across the plates is increased to 15 V, what will happen to the sphere?
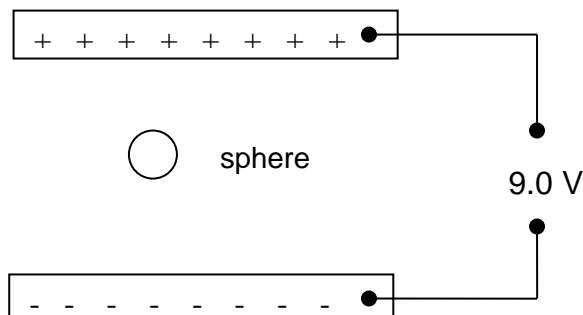

A It will remain stationary.
B It will accelerate upwards.
C It will accelerate downwards.
D It will move towards the right.

30 A battery drives 100 C of charge round a circuit. The total work done is 750 J. Which of the following describes correctly the type of particle moving around the circuit and the electromotive force of the battery?

	type of particle	e.m.f
A	positive charge	1.33 V
B	negative charge	1.33 V
C	negative charge	7.50 V
D	positive charge	7.50 V

31 Charge Q flows between two points X and Y in time t.
The potential difference between X and Y is V.
What is the current between the two points?

A Qt **B** VQ **C** VQt **D** $\dfrac{Q}{t}$

32 A metal strip of uniform thickness has a shape as shown in the diagram below. The narrower section has a width that is half that of the wider section.
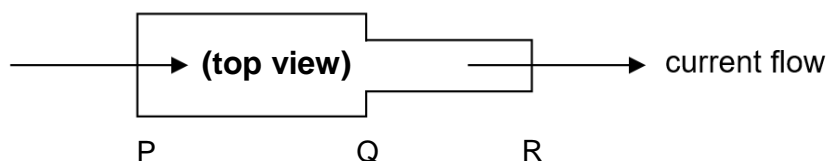

Which of the following statement(s) is / are true?

   i The current in the narrow section is less than the current in the wide section when current is passed along the strip.
  ii The resistance per unit length of the narrow section is twice that of the wide section.

A   **i** only
B   **ii** only
C   **i** and **ii** only
D   none of the above

33 Four different resistors are connected in the way as shown in the diagram below.
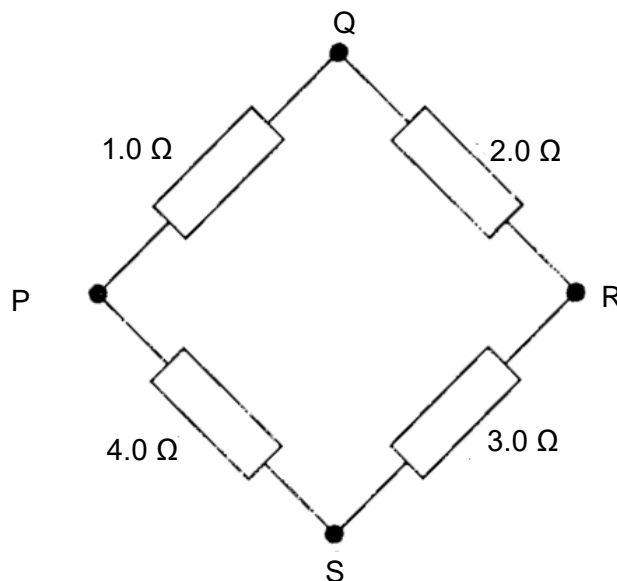

Between which two points would the resistance of the circuit be the greatest?

A   P and Q
**B**   Q and S
C   R and S
D   S and P

[Turn over

34 An electric heater has two identical heating elements that can be connected in three different ways, as shown below. The heater has three heat settings: low, medium and high.

Which option below indicates the way the heating elements must be connected in order to provide each respective setting?

SERIES

PARALLEL
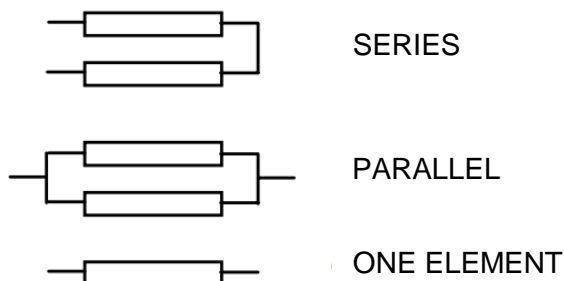
ONE ELEMENT

	high	**medium**	**low**
A	parallel	series	one element
B	parallel	one element	series
C	series	parallel	one element
D	series	one element	parallel

35 The circuit below shows a power supply with a constant electromotive force (e.m.f.) E. It is connected to a voltmeter, a variable resistor and two identical lamps, P and Q. Both lamps are lit.
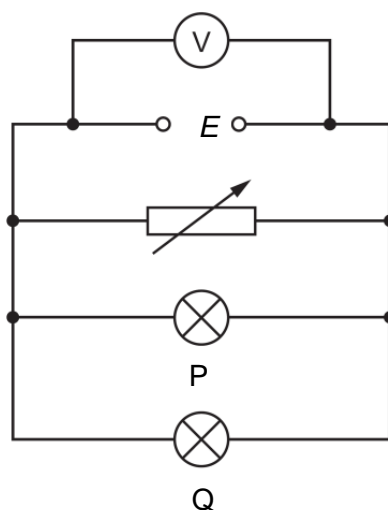
The resistance of the variable resistor is reduced.
What happens to the brightness of the lamp?

	lamp P	**lamp Q**
A	brighter	brighter
B	dimmer	dimmer
C	unchanged	unchanged
D	dimmer	unchanged

36 Which of the following is **not** a method to demagnetise a permanent magnet?

A heating
B hammering
C using a DC current
D using an AC current

37 A permanent bar magnet (NS) is placed in turn near two steel bars (PQ and XY) as shown below.

| N   S | attract | P   Q |
N S	repels	Q P
N S	attract	X Y
N S	attract	Y X

Which end is the magnetic north at?

A X
B Y
C P
D Q

38 The diagram below shows a beam of electrons about to enter a magnetic field. The direction of the field is into the page.

electron
beam
→

x x x x x x
x x x x x x   magnetic
x x x x x x   field into
x x x x x x   page
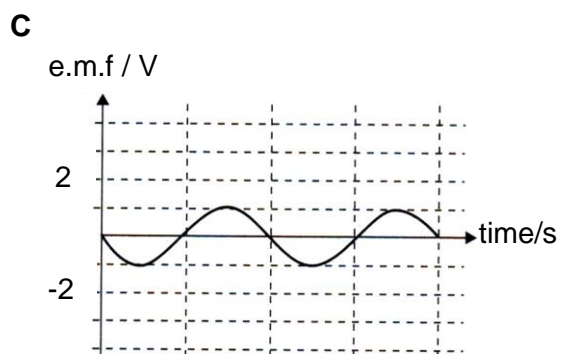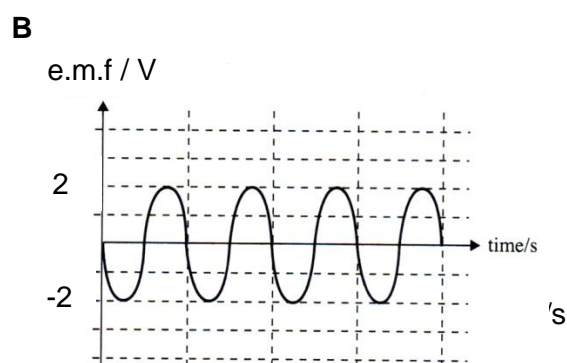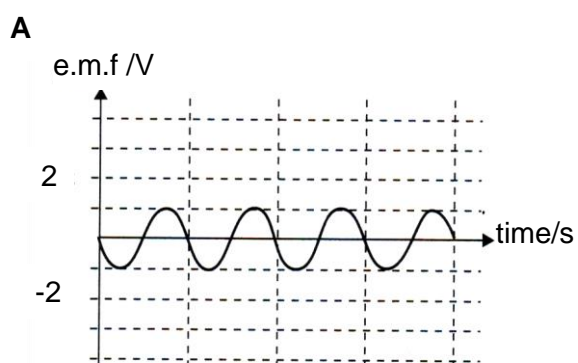
What will be the direction of the deflection, if any, as the beam passes through the magnetic field?

A no deflection
B upwards
C downwards
D into the page

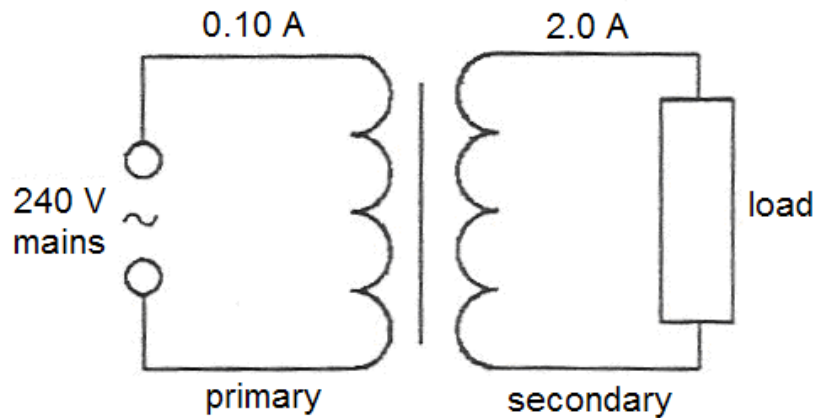**[Turn over**

39 The diagram shows how the e.m.f. of a simple a.c. generator varies with time.
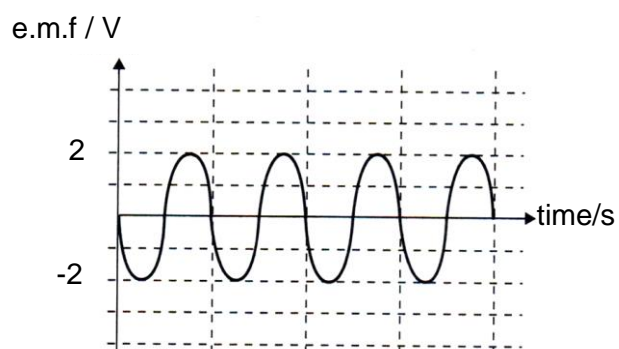
e.m.f / V

Which graph shows how the e.m.f varies with time when the generator rotates at half the original speed?

A

B

C

D
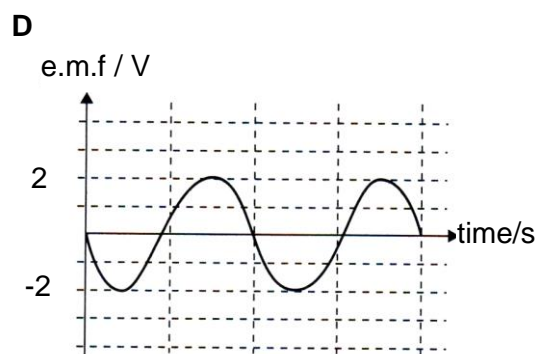
40 An ideal, mains-driven transformer supplies power to a load. In order to deliver a current of 2.0 A to the load, the primary coil draws a current of 0.10 A from the 240 V mains.

Which set of values in the table is correct?

	number of turns on primary coil	number of turns on secondary coil	potential difference across load / V
A	300	6000	12
B	6000	300	12
C	300	6000	4800
D	6000	300	4800