Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2018
Secondary Four

PHYSICS (ADVANCED)

Paper 3 Multiple Choice **50 minutes**

Tuesday **9 October 2018** **13:30 – 14:20**

Additional materials: Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page.

Do not use staples, paper clips, highlighters, glue or correction fluid on the Multiple Choice **Optical Answer Sheet** (OAS) provided.

Write your name, class and register number on the Optical Answer Sheet in soft pencil.

There are **thirty** 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 shade the lozenge of your choice in **soft pencil** on the Optical Answer Sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

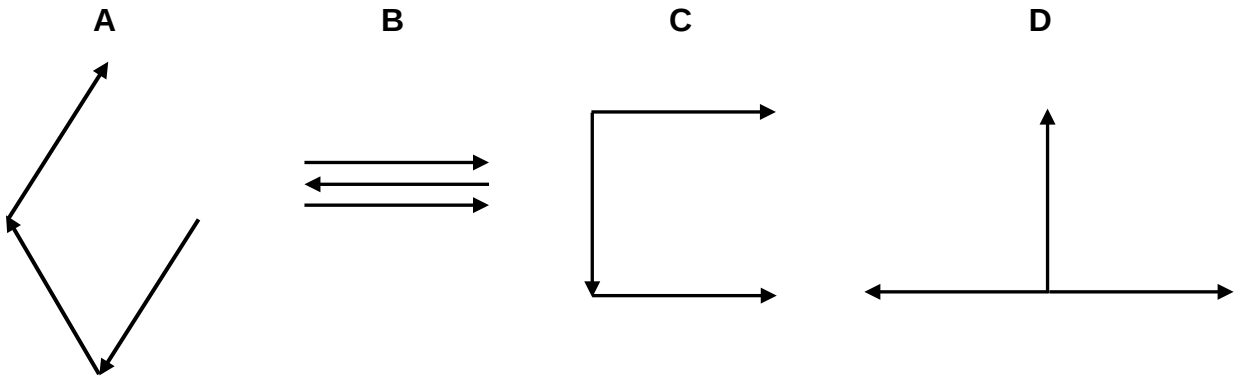
The use of an approved scientific calculator is expected, where appropriate.

Any rough working should be done in this booklet.

The acceleration due to gravity (or gravitational field strength) g is taken to be 10 m s^{-2} (or 10 N kg^{-1}) near the Earth's surface.

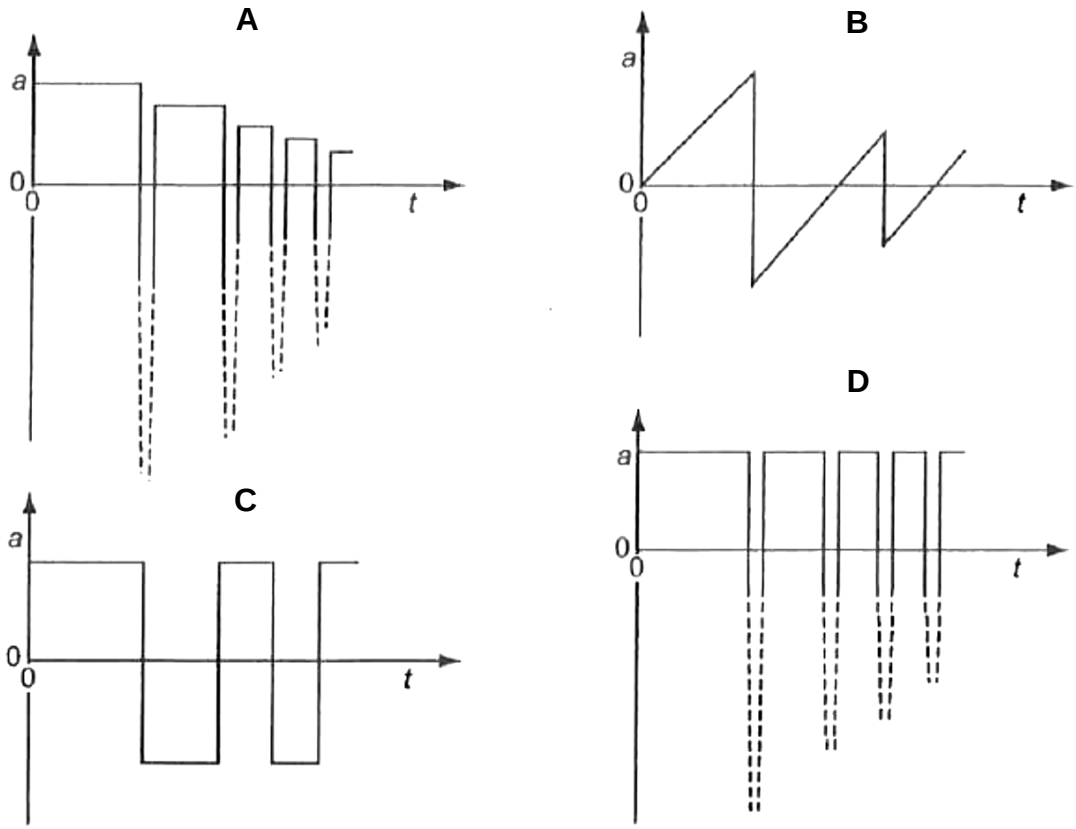
1 Each diagram shows three vectors of equal magnitude.

In which diagram is the magnitude of the resultant vector different from the other three?

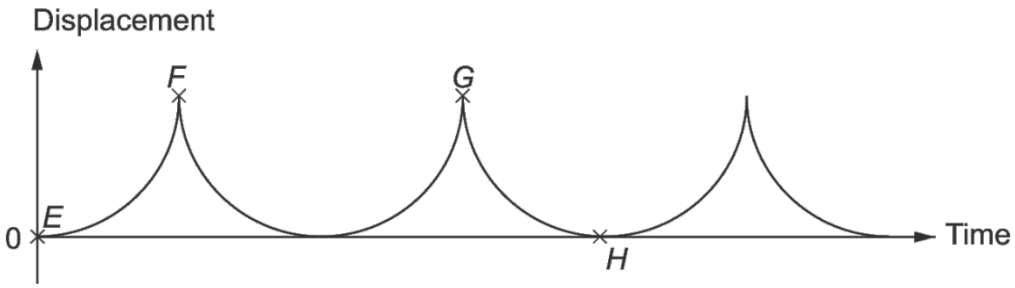


2 A steel ball is released from rest at a distance above a rigid horizontal surface and is allowed to bounce.

Which graph best represents the variation with time *t* of acceleration *a*?



3 The following is a displacement-time graph of a ping-pong ball that is released from a height of 1 m above a table with zero initial speed. The ping-pong ball bounces several times.



Neglecting the air resistance, which point in the graph represents the second bounce?

A *E*

B *F*

C *G*

D *H*

4 A ball is thrown at an angle of 37.0° from the horizontal with an initial velocity of 23.0 m s^{-1} and reaches a maximum height *h*. Neglect air resistance.

With what initial speed must the ball be thrown vertically upwards to reach the same maximum height *h*?

A 13.8 m s^{-1} **B** 17.3 m s^{-1}

C 18.4 m s^{-1} **D** 23.0 m s^{-1}

5 A puck moves with uniform acceleration on a straight air track (frictionless). It passes two points A and B with speed 2.0 m s^{-1} and 8.0 m s^{-1} respectively.

If the puck passes through the two points within a time of 0.1 s, what is the distance between A and B?

A 20 cm

B 30 cm

C 40 cm

D 50 cm

6 A juggler throws balls into air. He throws one whenever the previous one is at the highest point.

How high do the balls rise if he throws *n* balls each second?

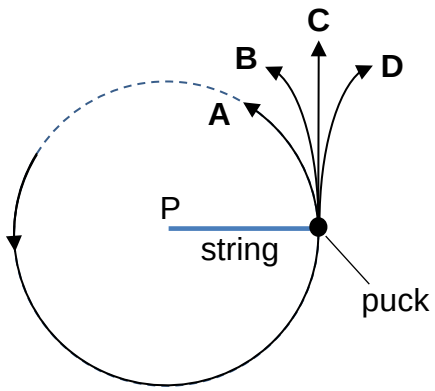
A $g / (4n^2)$

B $2n^2g$

C $g / (2n^2)$

D g/n

7 The diagram shows the top view of a frictionless sheet of ice. A puck, tied with a string to a point P, slides on the surface of the ice in the circular path shown.



If the string suddenly breaks when the puck is in the position shown above, which path best represents the puck's subsequent motion?

8 A person is pushing horizontally on a box with a constant force, causing it to slide across the floor with a constant speed. If the person suddenly stops pushing on the box, what will happen to the box?

A The box will immediately come to a stop.

B The box will continue moving at a constant speed for a while, then gradually slow down to a stop.

C The box will immediately move at a slower but constant speed.

D The box will immediately begin to slow down and eventually stop.

9 When does a girl in an elevator have the greatest apparent weight?

A when the elevator is moving downward at constant speed

B when the elevator is moving upward at constant speed

C when the elevator is moving downward with decreasing speed

D when the elevator is moving upward with decreasing speed

10 A racing car of mass 500 kg, including driver but not fuel, decelerates from a speed of 50 m s^{-1} to 30 m s^{-1} when approaching a bend.

The brakes exert a fixed retarding force of 7000 N. The time for the car to decelerate when it is almost out of fuel is t_1. The time for it to decelerate when it has a full load of 130 kg of fuel is t_2.

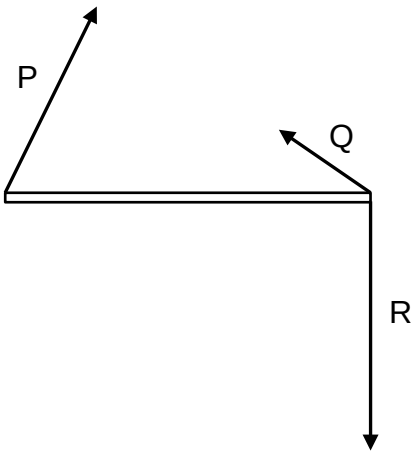
What is the difference (t_2 - t_1) in the two timings?

A 0.37 s **B** 0.56 s **C** 0.93 s **D** 1.43 s

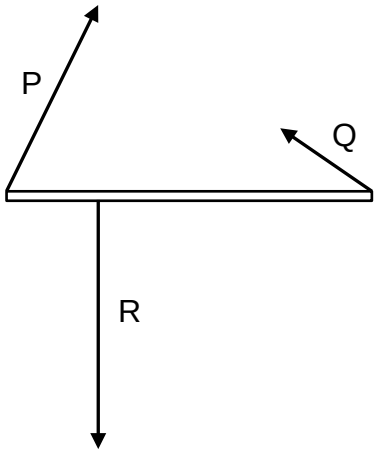
11 A light rod is acted upon by three forces P, Q and R.

Which diagram shows the position and direction of each of the forces when the rod is in equilibrium?

A



B



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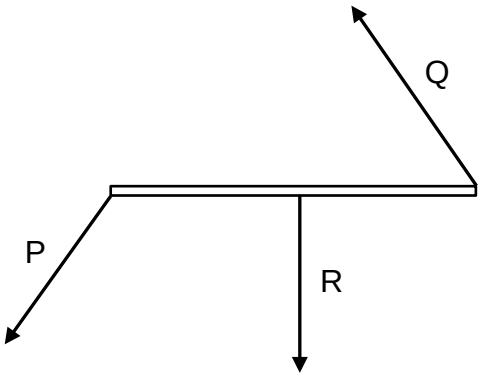
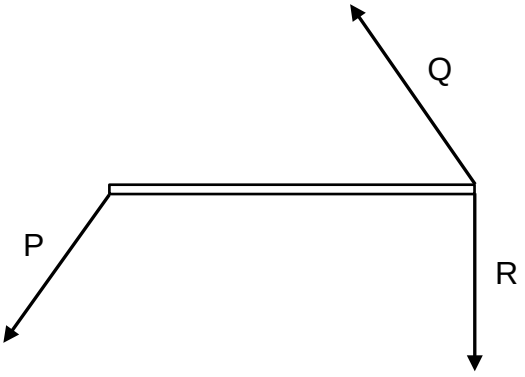
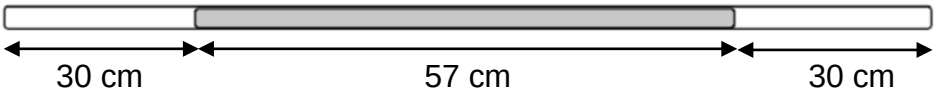


D



12 A uniform tube, closed at both ends, contains a 57cm long column of mercury which divides two columns of air of each 30 cm long as shown in the diagram below.
The air in the column is initially at an atmospheric pressure of 76 cmHg.



If the tube is then set upright on Earth, what are the eventual lengths of the top and bottom columns respectively?

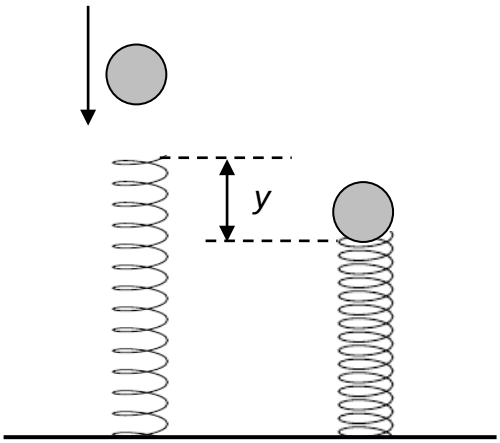
A 30 cm, 30 cm

B 35 cm, 25 cm

C 45 cm, 15 cm

D 40 cm, 20 cm

13 A ball of mass *m* falls freely from rest. When it has reached a speed *v*, it strikes a vertical spring. The spring is compressed by a distance *y* before the ball moves upwards again.



Assume that all the energy the ball loses (during the compression of the spring) becomes elastic potential energy in the spring.

What is the average force exerted by the spring during its compression?

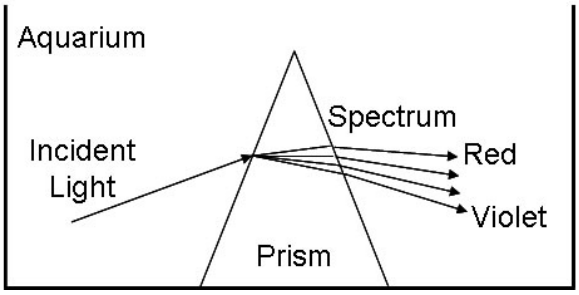
A $\frac{mv^2}{2y}$

B $\frac{m}{2y}(v^2 - 2gy)$

C $\frac{mv^2}{y}$

D $\frac{m}{2y}(v^2 + 2gy)$

14 A beam of white light is incident on a triangular glass prism with an index of refraction of about 1.5 for visible light producing a spectrum. Initially, the prism is in a glass aquarium filled with air as shown below.



If the aquarium is then filled with water with an index of refraction of 1.3, which of the following is true?

A The spectrum produced has less separation between red and violet than that produced in air.

B The spectrum produced has greater separation between red and violet than that produced in air.

C The positions of the red and violet are reversed in the spectrum.

D The spectrum produced is the same as that produced in air.

15 The critical angle for light going from medium *X* into medium *Y* is θ.
The speed of light in medium *X* is *v*.
What is the speed of light in medium *Y* ?

A $v / \cos \theta$

B $v \cos \theta$

C $v / \sin \theta$

D $v \sin \theta$

16 The S-waves (transverse) and P-waves (longitudinal) produced by earthquakes travel at different speeds through the earth.

If the S-waves travel about 4000 m s^{-1} while the P-waves travel at nearly 7000 m s^{-1}, how far away must an earthquake be for the P-waves to arrive 2.0 minutes before the S-waves?

A 360 km **B** 480 km **C** 840 km **D** 1120 km

17 A sound wave is emitted from a point source. The intensity of the sound wave is proportional to the square of the amplitude.

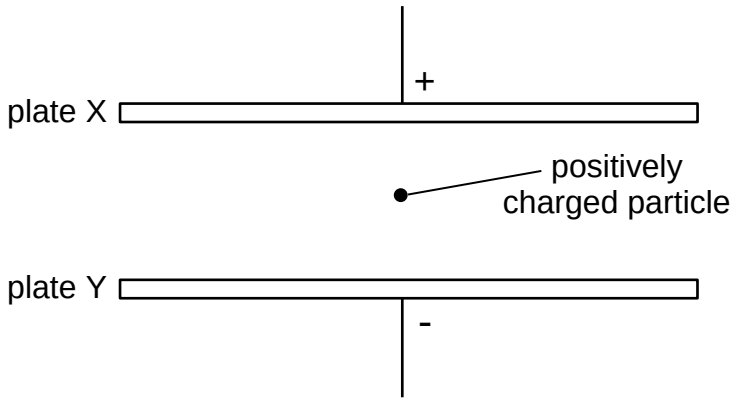
The intensity of the sound wave is also inversely proportional to the square of the distance from the source.

At a distance r from the source, the amplitude of the wave is $8X$.

What is the amplitude at a distance $2r$ from the same source?

A $8X$ **B** $4X$ **C** $2X$ **D** X

18 Two large parallel metal plates X and Y are situated in a vacuum as shown.



Plates X and Y carry equal and opposite charges.

What happens to the force on a positively charged particle as it moves from plate X to plate Y?

A It decreases because the positively charged particle is moving away from the positively charged plate.

B It decreases because the positively charged particle is moving in the direction of the electric field between the plates.

C It increases because the positively charged particle is moving closer to a negatively charged plate.

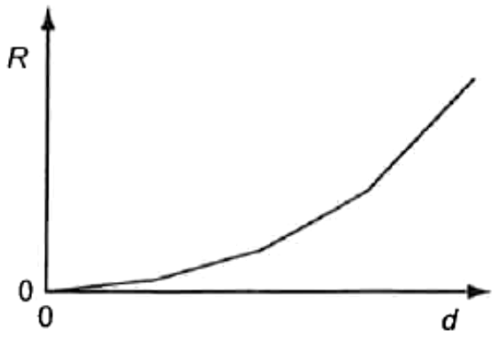
D It remains constant because the positively charged particle is in the uniform electric field between the plates.

19 A composite wire is made by connecting in series four uniform wires made of the same material but having different diameters.

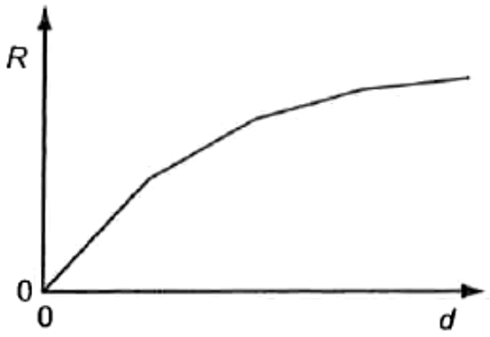
The resistance *R* of this composite wire is measured between X and other points on the wire at distances *d* from X.

Which graph best represents the relationship between *R* and *d*?

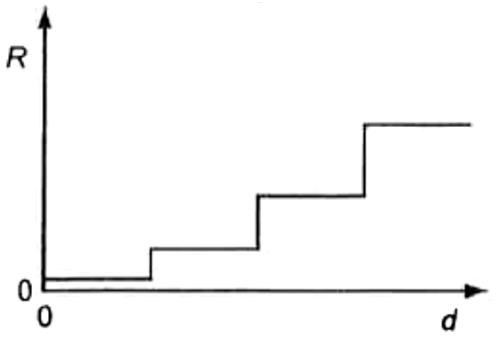
A



B



C



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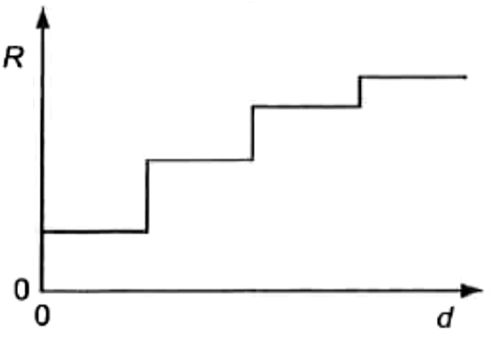
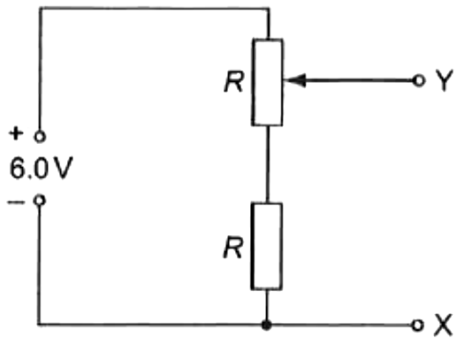


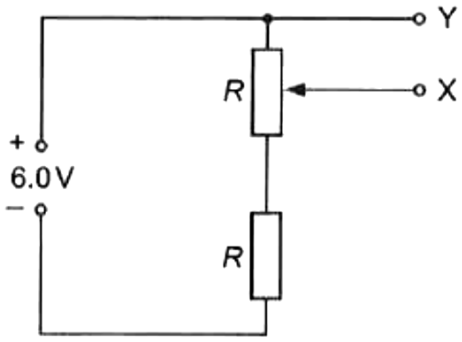
20 A potential divider has a constant supply of 6.0 V as shown in the diagrams.

Which circuit will provide a potential difference between X and Y that can be varied between zero and 3.0 V?

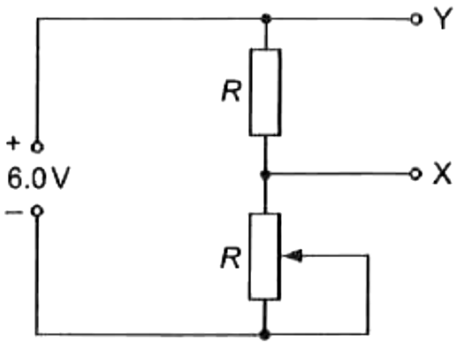
A



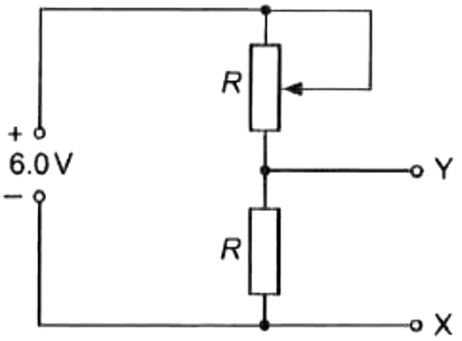
B



C



D



21 Three identical resistors are connected in parallel. The equivalent resistance increases by 700 Ω when one resistor is removed and connected in series with the remaining two, which are still in parallel.

What is the resistance of each resistor?

A 300 Ω

B 382 Ω

C 600 Ω

D 700 Ω

22 You are given a length *L* of resistance wire. When a potential difference of 120 V is applied across the full length of the wire, a power of 200 W is dissipated.

The wire is then cut into half to give two pieces each of length ½ *L* and these are connected in parallel. A potential difference of 120 V is applied across these two pieces of wire. What is the total power dissipated by both pieces of wire?

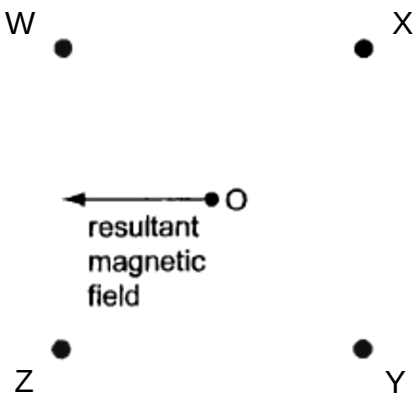
A 100 W

B 200 W

C 400 W

D 800 W

23 Parallel conductors WXYZ, carrying equal currents, pass vertically through the four corners of a square. In two conductors, the current is flowing into the page, and in the other two, out of the page.



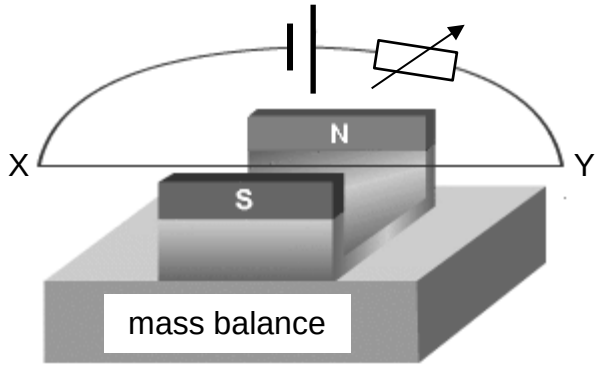
What are the directions of the current in order to produce a resultant magnetic field in the direction shown at O, the centre of the square?

	into the page	out of the page
A	W and X	Y and Z
B	W and Y	X and Z
C	X and Z	W and Y
D	Y and Z	W and X

24 A horseshoe magnet rests on a mass balance with a horizontal metal rod XY situated between the poles of the magnet. The rod is connected to a circuit as shown.

With no current in the rod, the reading on the balance is 142.0 g.

With a current of 2.0 A in the rod in the direction Y to X, the reading on the balance changes to 144.6 g.



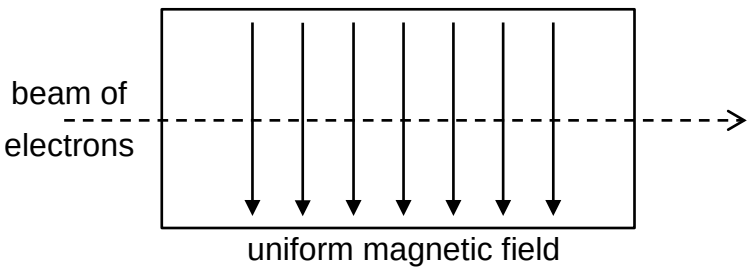
Adapted from https://www.s-cool.co.uk/a-level/physics/magnetic-fields/revise-it/magnetic-field-shapes-and-magnetic-field-strength-b

The battery polarity is reversed and the variable resistor is adjusted so that there is a current of 3.0 A in the rod in the direction X to Y.

What is the new reading on the balance?

A 148.5 g **B** 145.9 g **C** 140.7 g **D** 138.1 g

25 A beam of electrons enters a region in which there are magnetic and electric fields. The uniform magnetic field is directed downwards.



How should a uniform electric field be applied such that the beam of electrons passes straight through the region without deviation?

A into the plane of the paper

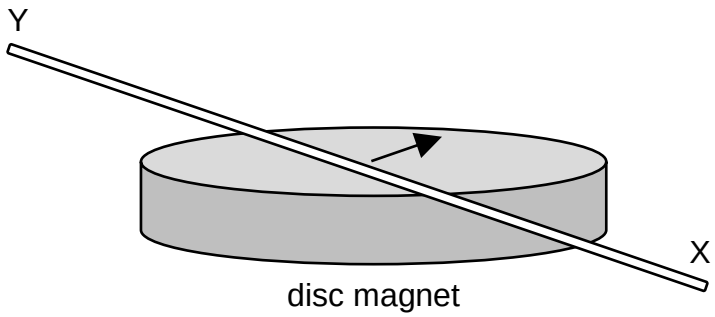
B out of the plane of the paper

C downwards along the plane of the paper

D upwards along the plane of the paper

26 A disc magnet has its poles on its opposing flat surfaces. An insulated copper wire XY was placed on top of the disc magnet as shown in the diagram.

The instant the wire was connected across a d.c. battery, the wire was observed to move in the direction of the arrow.



The statements below describe the direction of the magnetic field and the direction for the current in the wire XY. Which statement is consistent with the above observation?

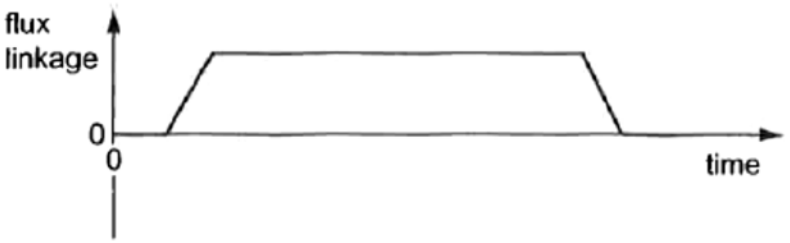
A The magnetic field was vertically upwards and the current was from X to Y.

B The magnetic field was vertically upwards and the current was from Y to X.

C The magnetic field was in the direction of the arrow and the current was from X to Y.

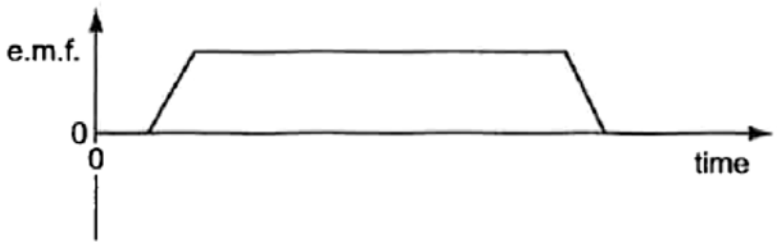
D The magnetic field was in the direction of the arrow and the current was from Y to X.

27 The magnetic flux linkage through a coil varies with time as shown.



Which graph shows the variation with time of the e.m.f. generated by the coil?

A



B

C

D

28 In an experiment to determine the specific heat capacity of a liquid by an electrical method, a student obtained the following results.

mass of liquid heated	1.5 kg
initial liquid temperature	300 K
final liquid temperature	357 K
electrical power of heater	1.01 kW
time of heating	180 s

What is the specific heat capacity of the liquid?

A 2.1 J kg^{-1} K^{-1}

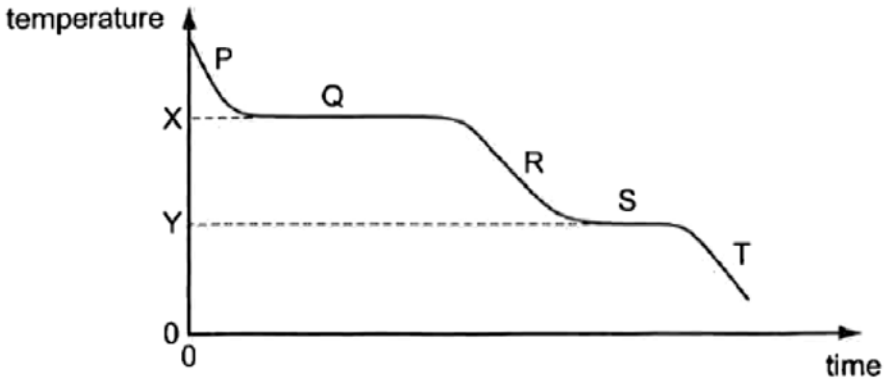
B 18 J kg^{-1} K^{-1}

C 1800 J kg^{-1} K^{-1}

D 2100 J kg^{-1} K^{-1}

29 A vapour in a container is at a high temperature and loses heat to its surroundings.

The graph shows how its temperature changes over the next few minutes.



Which feature of the graph indicates that the specific latent heat of vaporisation of the substance is greater than its specific latent heat of fusion?

A The gradient of the graph at P is greater than the gradient at R.

B The gradient of the graph at T is greater than the gradient at R.

C The length of the line Q is greater than the length of the line S.

D The value of X is greater than the value of Y.

30 A 50 g lead bullet, with specific heat capacity, 129 J / (kg °C) is initially at 300 °C. It is fired vertically upwards with a speed of 840 m s^{-1} and on returning to the starting level strikes a cake of ice at 0 °C.

Latent heat of fusion of water = 3.34 x 10^5 J kg^{-1}.

How much ice has melted? Assume that all the energy is spent in melting only.

A 39 g **B** 59 g **C** 79 g **D** 99 g

End of paper

Qn	Answer
1	C
2	D
3	C
4	A
5	D
6	C
7	C
8	D
9	C
10	A
11	B
12	D
13	D
14	A
15	C
16	D
17	B
18	D
19	A
20	B
21	C
22	D
23	A
24	D
25	B
26	A
27	C
28	D
29	C
30	B