Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

PHYSICS **6091/01**
Paper 1 Multiple Choice **28 August 2024**
1 hour

Additional Materials:
Optical Test Answer Sheet (OTAS) – 1 sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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

The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:
(1) Optical Test Answer Sheet (OTAS)
(2) Question Paper

This document consists of **17** printed pages.

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1 A student studies some equations for his Physics Examination.

power = work done / time
force = mass x acceleration
velocity = displacement / time

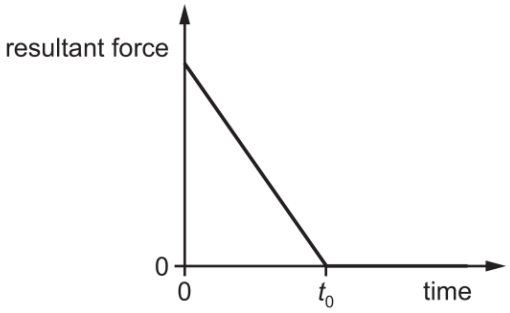
How many different scalar quantities are there in all the equations?

A 2 **B** 3 **C** 4 **D** 5

2 Which of the following equations is correct?

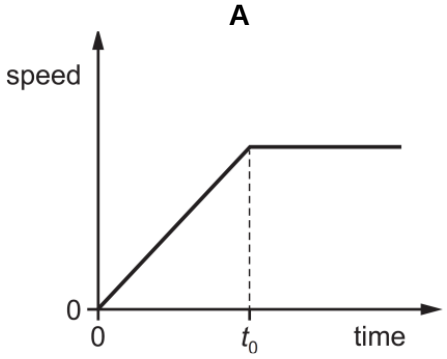
A 43 N / mm^2 = 4.3 x 10^{-2} N / m^2
B 63 Hz = 6.3 x 10^9 GHz
C 85 µm = 8.5 x 10^3 m
D 123 nA = 1.23 x 10^{-7} A

3 A resultant force acts on an object and causes it to move in a straight line. The graph shows how the resultant force varies with time.

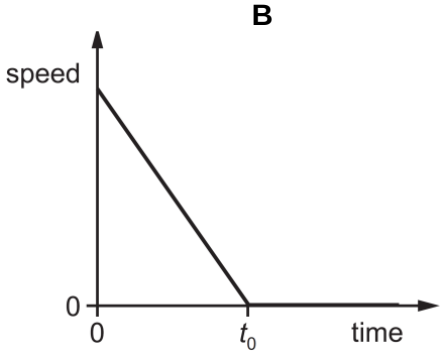


Which graph is the speed-time graph for the object?

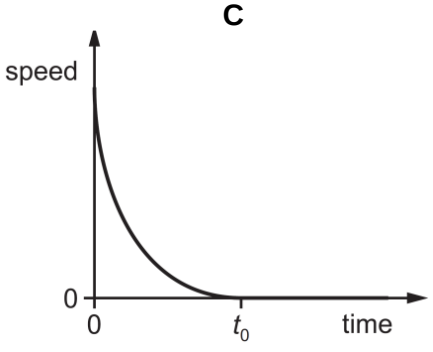
A



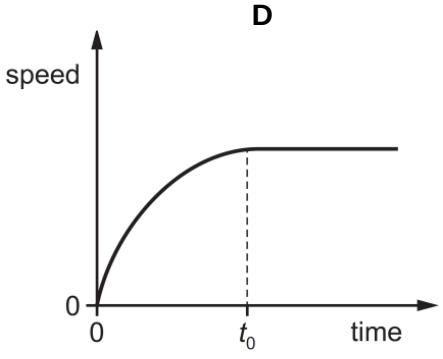
B



C

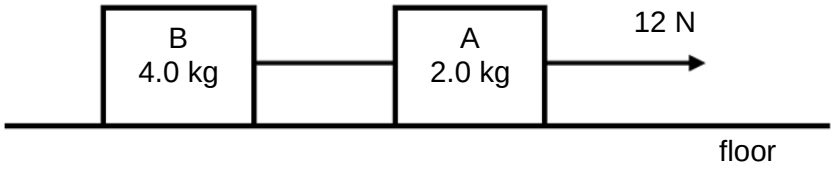


D



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4 Block A and block B are connected by a light inextensible string. A force of 12 N acts on block A as shown.



Given that the floor is smooth, what is the tension in the string connecting block A and block B?

A 2.0 N **B** 4.0 N **C** 8.0 N **D** 12 N

5 Which of the following is **not** an example of an action-reaction pair based on Newton's laws of motion?

A A student pulling a bag forward, the bag pulling the student backwards.

B Weight of a book resting on the table, and the normal contact force the table exerts on the book.

C Driving wheel of a bicycle exerting friction on the road, and the road exerting friction on the wheel.

D Earth pulling a skydiver with gravitational force, and skydiver pulling Earth with a gravitational force.

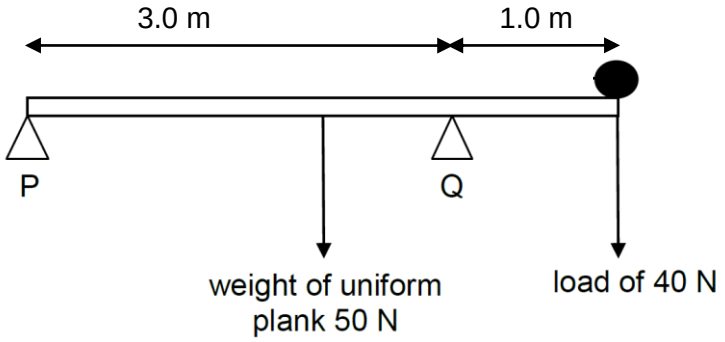
6 The weight of a rock on Venus is less than its weight on Earth.

How do the mass of the rock and gravitational field strength on Venus compare with their respective values on Earth?

	mass of rock	gravitational field strength
A	smaller	smaller
B	smaller	zero
C	same	smaller
D	same	same

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7 A 4.0 m long uniform plank weighing 50 N balances on two pivots P and Q when a load of 40 N is placed at one end.

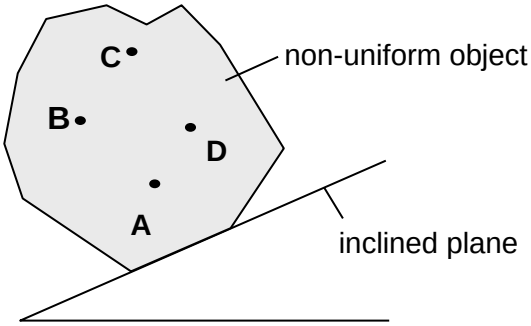


What are the normal contact forces at points P and Q?

	normal contact force at P	normal contact force at Q
A	3	87
B	20	70
C	45	45
D	67	23

8 A non-uniform object is placed on an inclined plane. The object is just about to topple.

Which position is most likely to be its centre of gravity?

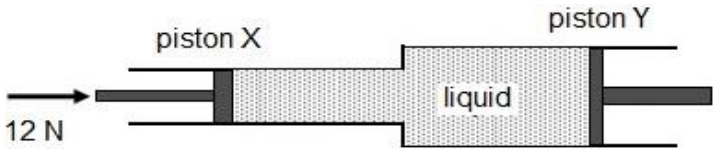


9 Which of the following would most likely sink into soft mud?

A a loaded truck with six wheels
B a loaded truck with four wheels
C an empty truck with six wheels
D an empty truck with four wheels

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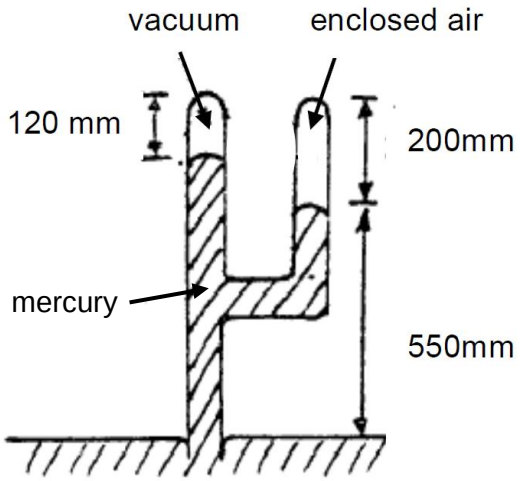
10 The diagram shows a cylinder fitted with two pistons X and Y of diameters 5.0 cm and 10.0 cm respectively. The piston X is pushed by a force of 12 N.



What is the force exerted on piston Y?

A 3.0 N **B** 6.0 N **C** 24 N **D** 48 N

11 The diagram below shows a manometer.

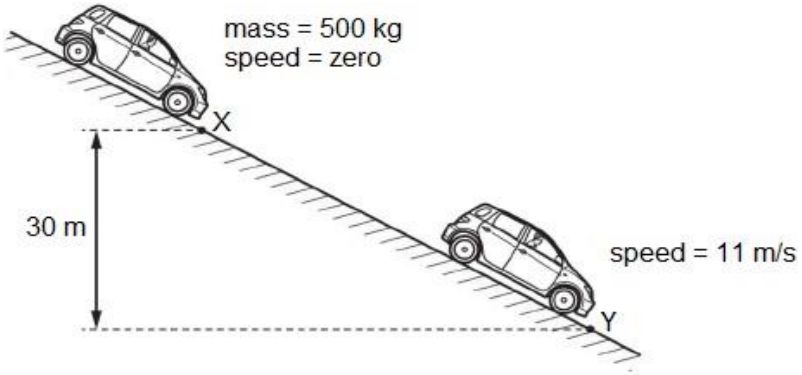


What is the pressure of the enclosed air in the manometer?

A 80 mmHg **B** 120 mmHg
C 200 mmHg **D** 550 mmHg

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12 A car of mass 500 kg is at rest at point X on a slope, as shown. The car's brakes are released and the car rolls down the slope with its engine switched off.



At point Y, the car has moved through a vertical height of 30 m and has a speed of 11 m/s.

What is the energy dissipated by frictional forces when the car moves from X to Y?

A 3.0×10^4 J **B** 1.2×10^5 J
C 1.5×10^5 J **D** 1.8×10^5 J

13 A 5.0 W lamp is switched on for 180 s. It transfers 600 J to the internal store (thermal) of the surroundings.

What is the efficiency of the lamp?

A 33 % **B** 43 %
C 67 % **D** 70 %

14 When smoke particles are viewed under a microscope, they can be seen moving with Brownian motion.

Which row describes and explains Brownian motion?

	description	explanation
A	random	air molecules bombard the smoke particles
B	random	smoke particles bombard the air molecules
C	vibration	air molecules bombard the smoke particles
D	vibration	smoke particles bombard the air molecules

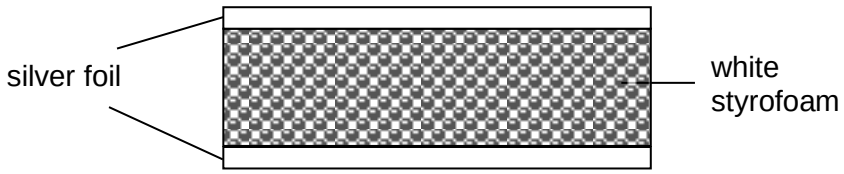
15 A gas is heated in a rigid sealed container.

Which quantity does not change?

A The average speed of the gas particles.
B The average distance between the gas particles.
C The average force exerted on the walls of the container by the gas particles.
D The frequency of collisions on the walls of the container by the gas particles.

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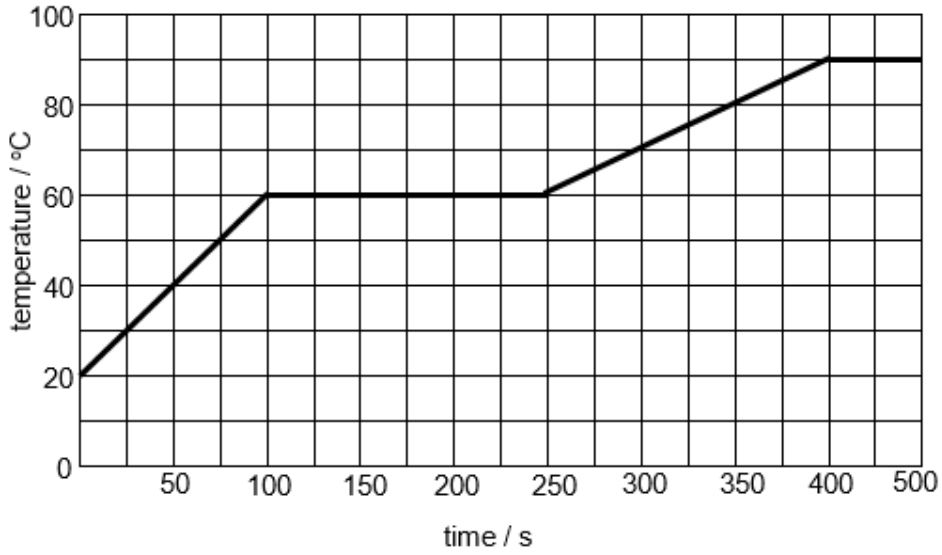
16 A type of insulation board used in the construction of houses in cold climate is shown below.



Which part of the board reduces energy transfer to the surrounding by conduction and why?

	part	reason
A	silver foil	shiny surface is a good reflector of radiation
B	silver foil	shiny surface is a poor emitter of radiation
C	styrofoam	it contains air which is a poor thermal conductor
D	styrofoam	it is white in colour which is a poor absorber of radiation

17 A solid of 2.0 kg is heated by a 2000 W heater. The graph of temperature against time for the substance is shown in the diagram.

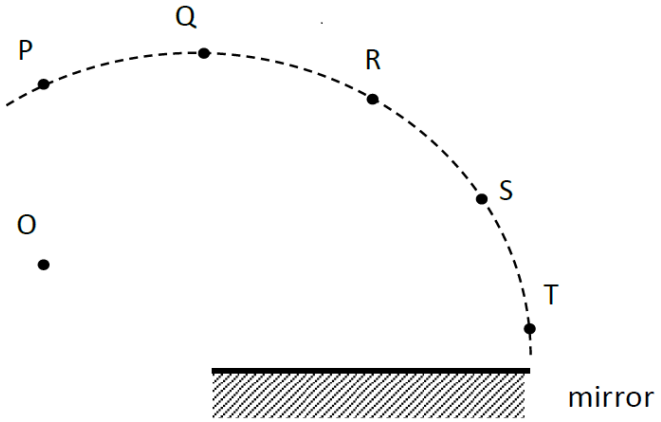


What is the specific latent heat of fusion of the solid?

A 2.0 kJ / kg
B 30 kJ / kg
C 150 kJ / kg
D 300 kJ / kg

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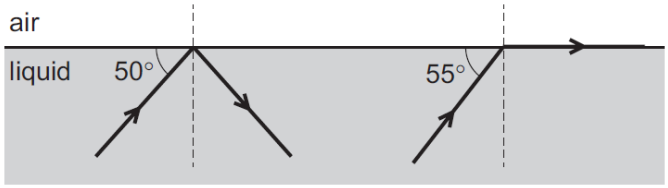
18 An object O is placed in front of a mirror.



Where must the observer position himself such that he will be able to see the image of O in the mirror?

A between S and T
B between R and S
C between Q and R
D between P and Q

19 The diagram represents the surface of a transparent liquid. Two rays of light are travelling within the liquid. They both reach the surface. The path of each ray is shown.

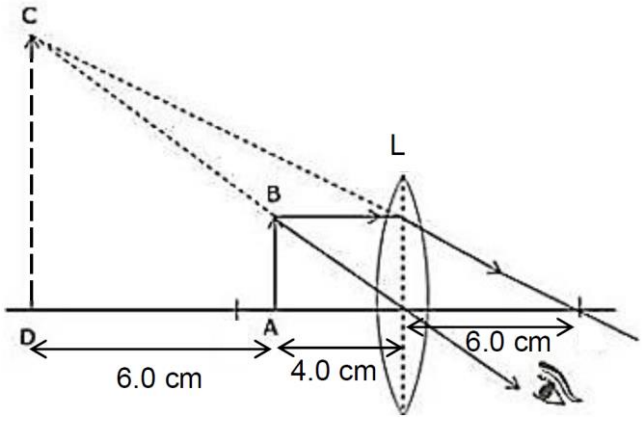


What is the refractive index of this liquid?

A 1.2 **B** 1.3 **C** 1.6 **D** 1.7

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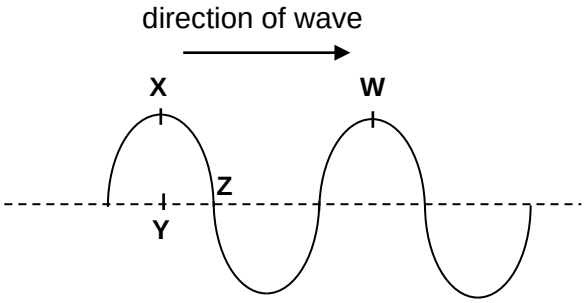
20 A converging lens L acts as a magnifying glass when an object AB is placed 4.0 cm from the centre of the lens. The image CD is 6.0 cm from A. Focal length of the lens is 6.0 cm.



What are the characteristics of the image formed when the object is placed 12.0 cm away from the centre of the lens ?

A virtual and same size as object
B real and same size as object
C virtual and diminished
D real and diminished

21 The diagram shows a water wave traveling towards the right.



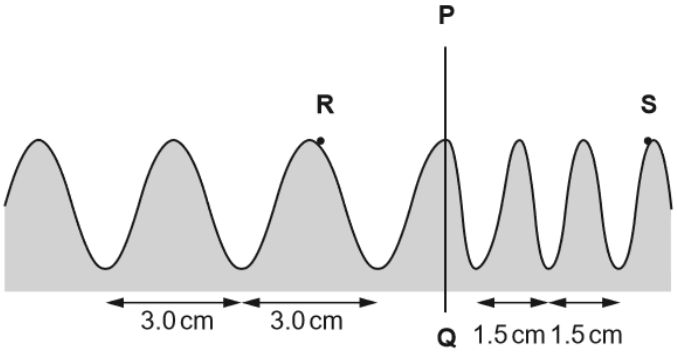
Which of the following statements are **not correct**?

I Particles at X and W are in phase.
II Particle at X will move to W after a period.
III Particle at Z will move up in the next instant.
IV Wavelength of the wave is represented by XY.

A I and III only
B II and IV only
C I, II and IV only
D all the above

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22 The diagram shows a water wave in a ripple tank.



The wave has a speed of 0.15 m / s at R.

The wave crosses a boundary PQ where the distance between troughs changes from 3.0 cm to 1.5 cm.

What is the velocity of the wave at point S?

A 0.075 m / s
B 0.15 m / s
C 0.30 m / s
D 0.45 m / s

23 Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high speed internet and network connections.

Which statement below correctly describes the radio waves?

A The waves cannot be reflected.
B The waves are longitudinal in nature.
C The waves can travel longer distances than gamma ray.
D Speed of the waves in vacuum will be faster at higher frequency.

24 Which of the following shows the correct part of the electromagnetic spectrum that is being used for various applications?

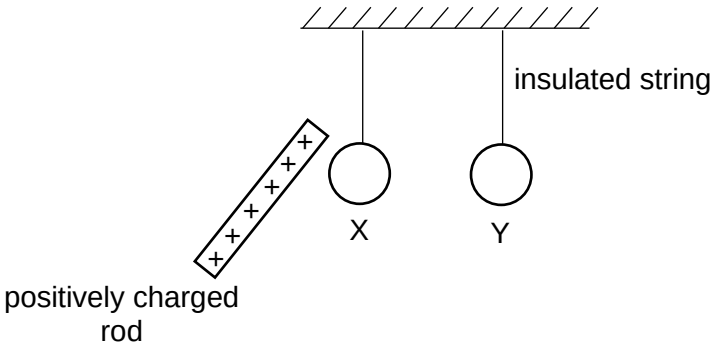
	satellite communications	sterilisation of surgical equipment	telecommunications
A	microwave	ultraviolet radiation	radio wave
B	microwave	infrared radiation	radio wave
C	radio wave	infrared radiation	microwave
D	radio wave	ultraviolet radiation	microwave

25 Which list shows electromagnetic waves in order of increasing frequency?

A x-rays, gamma rays, visible light
B visible light, x-rays, gamma rays
C visible light, gamma rays, x-rays
D gamma rays, x-rays, visible light

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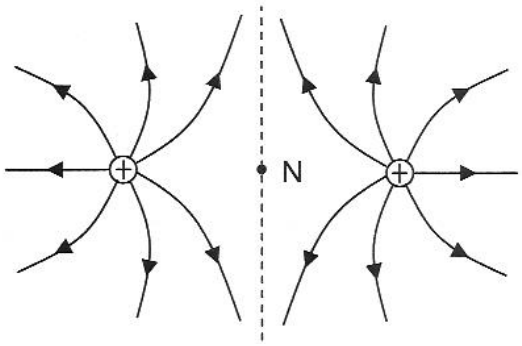
26 The diagram shows a positively-charge rod placed near two metal spheres X and Y, insulated and hung by non-conducting strings. Both spheres are initially uncharged.



What would be the charges on both spheres after sphere X is earthed?

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

27 An electron is placed at the point N in the electric field as shown below where point N is the centre of two identical positive charges.



What is the motion of the electron?

A moves out of the plane of paper

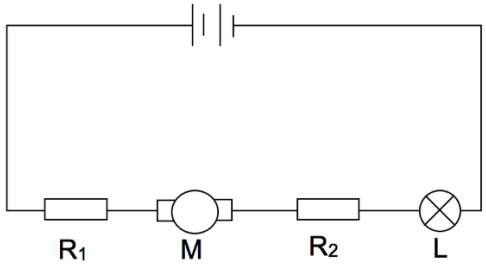
B moves downwards

C moves upwards

D does not move

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28 In the circuit shown below, two resistors R_1 and R_2, a motor M and lamp L are connected to a suitable voltage supply.



The potential difference across each of the circuit component is measured and recorded as shown in the table below.

Circuit Component	R_1	M	R_2	L
Potential difference / V	6.0	10.0	3.0	1.0

Which of the following inference is **not** true?

A The resistance of R_1 is twice the resistance of R_2.

B The motor uses the greatest amount of electrical energy per unit time.

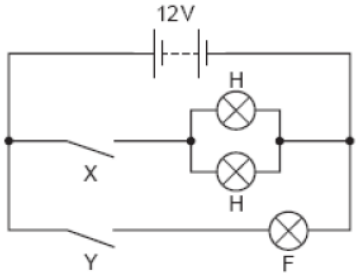
C The lamp has the least amount of current passing through compared to other components.

D If the motor is removed from the circuit and replaced with a wire, the current through each component would be two times the existing value.

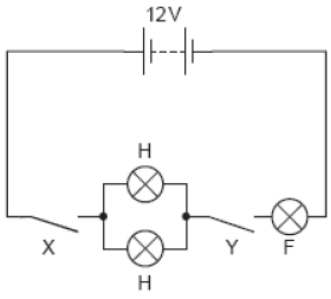
29 In a car, the identical headlamps H are controlled by switch X. The fog lamp F is controlled by switch Y and only lights up if the headlamps are also switched on. Lamps H and F have a normal working voltage of 12 V.

Which circuit would allow all the lamps to work as above at normal brightness?

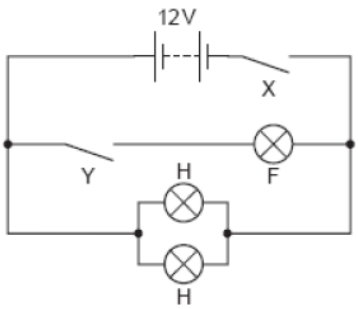
A



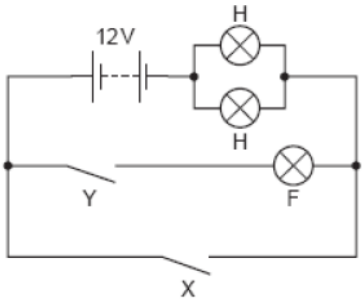
B



C

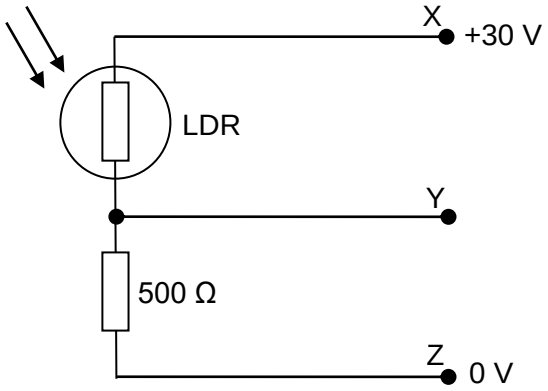


D



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30 A light dependent resistor (LDR) and a 500 Ω resistor form a potential divider between voltage lines held at +30 V and 0 V as shown in the diagram. The resistance of the LDR is 1000 Ω in the dark but drops to 100 Ω in bright light.



What is the corresponding change of potential difference between X and Y when the LDR is placed in a dark room and then move to a bright room?

A a fall from 30 V to 5 V
B a fall from 20 V to 5 V
C a rise from 5 V to 30 V
D a rise from 5 V to 20 V

31 An electric heater which is rated '240 V, 1500 W' is connected to a 3-pin socket.

Which of the following correctly describes the current in the neutral wire and the potential difference between the earth and neutral wire during normal operation?

	current in neutral wire / A	potential difference between earth and neutral wire / V
A	0	0
B	6.25	240
C	0	240
D	6.25	0

32 A 3-pin plug is connected to a heater with a rating of '200V, 1200 W'.

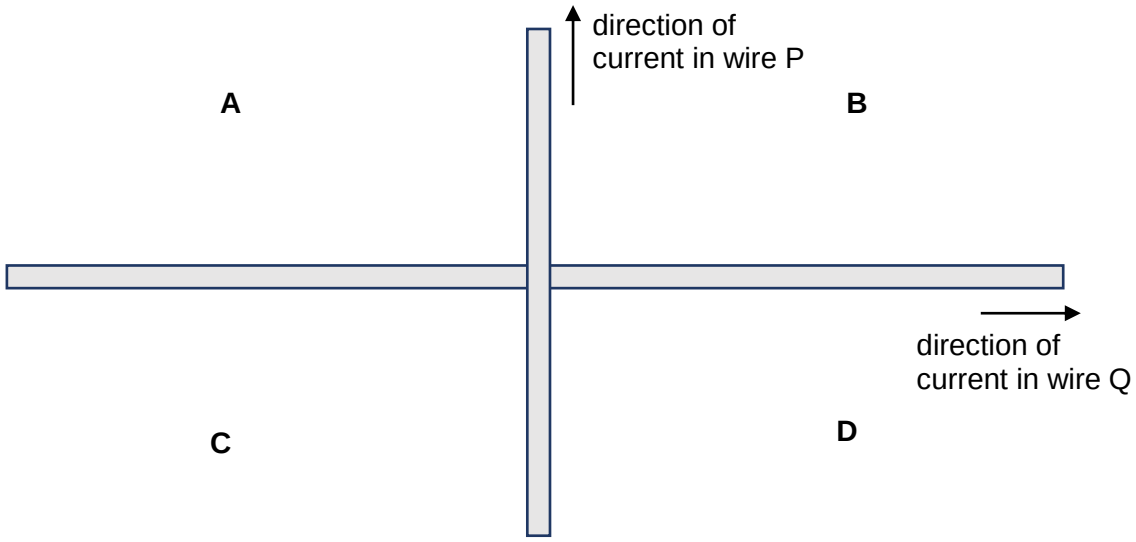
Which of the following is/are correct?

1 A 5 A fuse should be used inside the heater.
2 The fuse should be placed on the brown wire of the cable.
3 The neutral wire should be connected to the metal case of the heater.

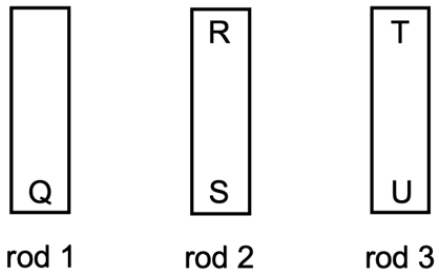
A 2 only
B 3 only
C 1 and 2 only
D 2 and 3 only

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33 The diagram shows two insulated wires, P and Q, each with the same amount of current flow. Which region **A**, **B**, **C** or **D** has the strongest magnetic field out of the paper?



34 The ends of three metal rods are tested by holding end Q of rod 1 close to each end of rods 2 and 3.



The results are as follows:

End Q attracts end R.
End Q attracts end S.
End Q attracts end T.
End Q repels end U.

Which of the metal rods is a magnet?

A rod 2 and rod 3 only

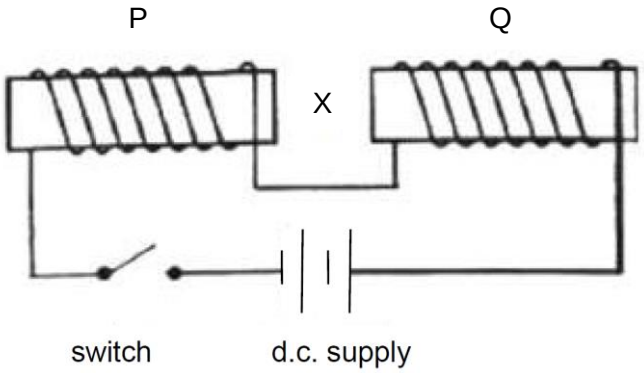
B rod 1 and rod 3 only

C rod 1 only

D rod 2 only

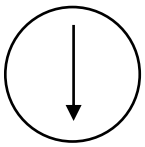
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35 The figure shows an iron bar P and steel bar Q being wound by wire and connected to a d.c. supply. A compass is placed between the two metal bars at position X.

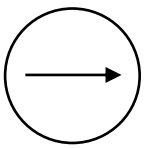


Which option shows the correct position of the compass needle when the switch is closed?

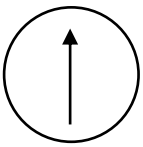
A



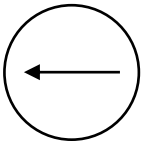
B



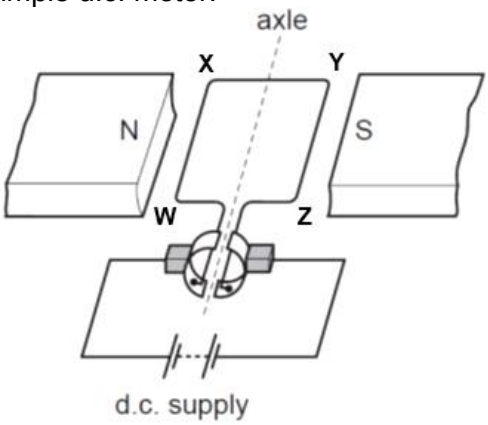
C



D



36 The diagram below shows a simple d.c. motor.



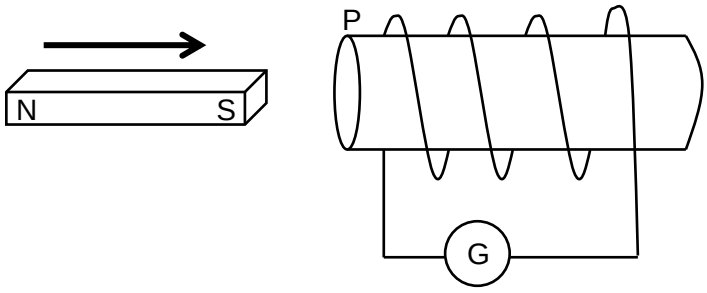
Which of the following statements is/are correct?

I A current will flow round the coil in the direction WXYZ.
II The coil will rotate in a clockwise direction about the axle.
III The split-ring commutator will reverse the direction of the current every 360°.

A I only
B I and II only
C I and III only
D II and III only

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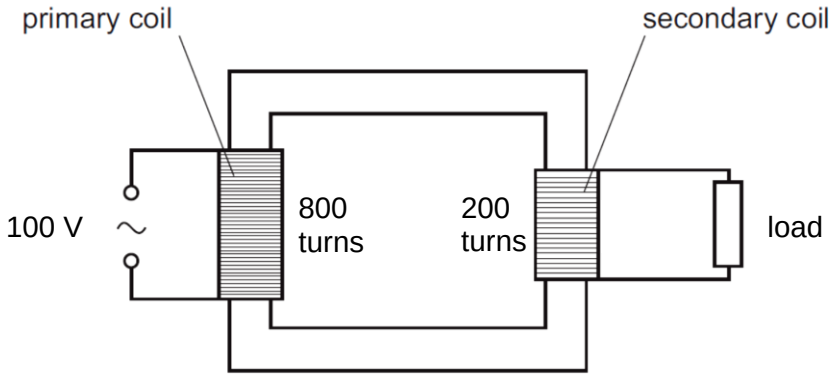
37 The diagram shows a permanent magnet approaching a solenoid at a constant speed.



What is the polarity of the solenoid at P and the direction of the deflection in the galvanometer?

	polarity of solenoid at P	direction of the deflection in galvanometer
A	north pole	to the right
B	north pole	to the left
C	south pole	to the right
D	south pole	to the left

38 The diagram shows an ideal transformer. An alternating current supply of 100 V is supplied to the primary coil and a current of 0.50 A flows through it.



What is the potential difference across the load and the current flowing through it?

	potential difference / V	current / A
A	50	2.0
B	50	1.0
C	25	2.0
D	25	1.0

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39 A neutral atom of an isotope has the nuclide notation $^{84}_{36}Kr$.

Which statement is correct?

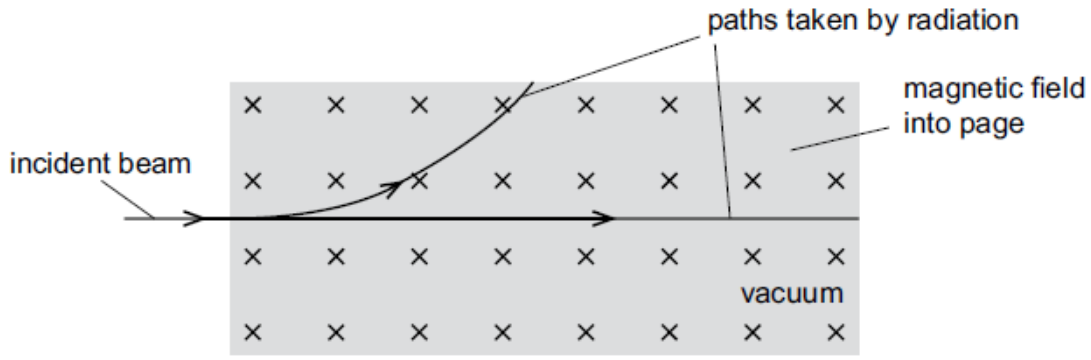
A There are 12 more neutrons than electrons in the atom.

B There are 36 electrons in the nucleus of the atom.

C There are 45 neutrons in the nucleus of the atom.

D There are 48 protons in the nucleus of the atom.

40 A beam of radiation enters a region in which there is a very strong, uniform magnetic field directed into the page. All the equipment is in a vacuum.



The beam splits and the curved path and the straight path taken by the radiation in the magnetic field are shown on the diagram.

What types of radiation are in the incident beam?

A β-particles and γ-rays only

B α-particles and γ-rays only

C α-particles and β-particles only

D α-particles, β-particles and γ-rays

End of Paper

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ANSWERS

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

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