Name: _____ ( ) PDG: _____/15

ANDERSON JUNIOR COLLEGE

2016 JC2 Preliminary Examination

PHYSICS Higher 1 8866/01

Paper 1 Multiple Choice **23 September 2016**

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 index number and PDG in the spaces provided above.

Write your name and PDG on the Answer Sheet.
Shade and write your NRIC/FIN.

There are **thirty** 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 Answer Sheet.

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 paper.

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

This document consists of **13** printed pages and **1** blank page.

Data

speed of light in free space,	$c = 3.00 \times 10^{8}$ m s^{-1}
elementary charge,	$e = 1.60 \times 10^{-19}$ C
the Planck constant,	$h = 6.63 \times 10^{-34}$ J s
unified atomic mass constant,	$u = 1.66 \times 10^{-27}$ kg
rest mass of electron,	$m_e = 9.11 \times 10^{-31}$ kg
rest mass of proton,	$m_p = 1.67 \times 10^{-27}$ kg
acceleration of free fall,	$g = 9.81$ m s^{-2}

Formulae

uniformly accelerated motion,	$s = ut + \frac{1}{2} at^2$ $v^2 = u^2 + 2as$
work done on/by a gas,	$W = p\Delta V$
hydrostatic pressure,	$p = \rho gh$
resistors in series,	$R = R_1 + R_2 + \ldots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \ldots$

1 Which of the following quantity has a unit that can be expressed in terms of two different SI base units?

A area

B charge

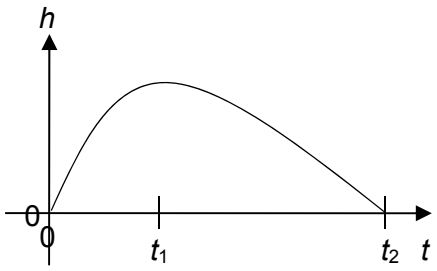
C current

D force

2 Two forces of 4.0 N and 6.0 N act at a point. Which one of the following could **not** be the magnitude of their resultant?

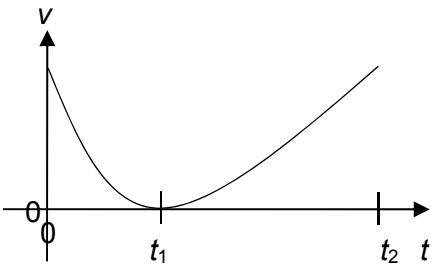
A 1.0 N **B** 4.0 N **C** 6.0 N **D** 9.8 N

3 A ball is thrown vertically upwards and returns along the same path. The graph shows how its height *h* above the ground varies with time *t*.

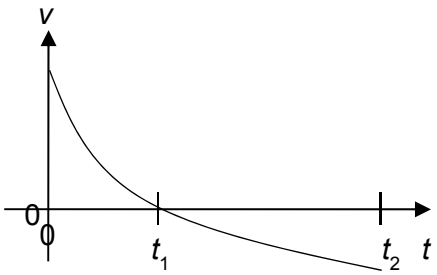


Which graph shows the variation with time *t* of the velocity *v* of the ball?

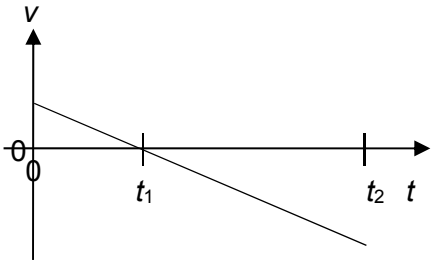
A



B



C



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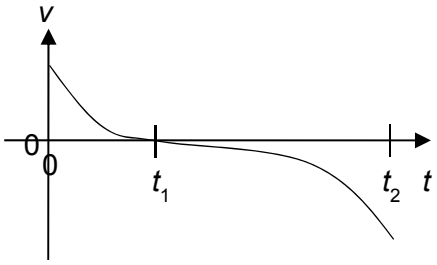


4 An object is projected at an angle to the horizontal and it follows a parabolic path, PQRST. These points are the positions of the object after successive equal time intervals, T being the highest point reached.

Which statement is true about the displacement PQ, QR, RS and ST?

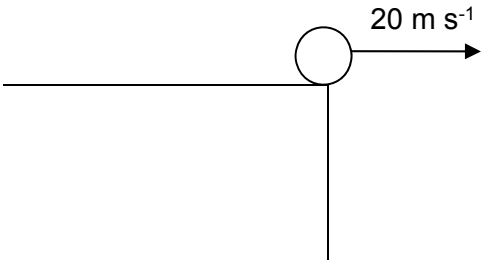
A The displacements are equal.

B The displacements decrease at a constant rate.

C The displacement have equal vertical components.

D The displacement have equal horizontal components.

5 A ball is projected horizontally from a cliff with a velocity of 20 m s^{-1}. Air resistance is negligible.



What is the time when its vertical component of velocity is twice that of its horizontal component?

A 1.0 s **B** 2.0 s **C** 4.1 s **D** 9.8 s

6 Two spheres travel along the same line with velocities u_1 and u_2. They collide and after collision their velocities are v_1 and v_2.

Which collision is **not** elastic?

	u_1	u_2	v_1	v_2
A	3	-3	0	6
B	3	-2	1	6
C	5	2	3	6
D	2	-5	-5	-2

7 With the effect of air resistance, a cyclist and his bicycle of total mass 80.0 kg can coast down a 5.0° (with respect to the horizontal) hill at a constant speed of 1.38 m s^{-1}.

If the air resistance F_{air} is proportional to the cyclist's speed v such that $F_{air} = kv$, where k is a constant, what is the additional force that the cyclist must apply in order to descend the hill at a steady speed of 5.55 m s^{-1}?

A 107 N **B** 207 N **C** 307 N **D** 407 N

8 A body, initially at rest, explodes into two masses M_1 and M_2 that move apart with speeds v_1 and v_2 respectively.

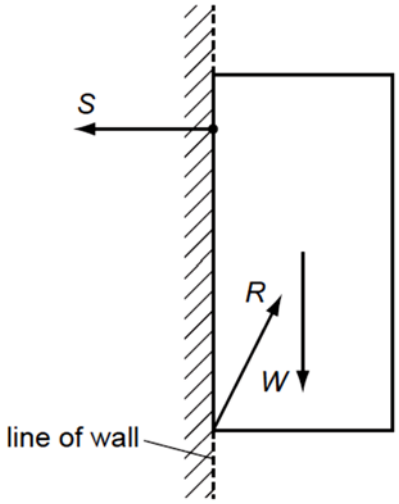
What is the ratio $\frac{v_1}{v_2}$?

A $\frac{M_1}{M_2}$ **B** $\frac{M_2}{M_1}$ **C** $\sqrt{\frac{M_1}{M_2}}$ **D** $\sqrt{\frac{M_2}{M_1}}$

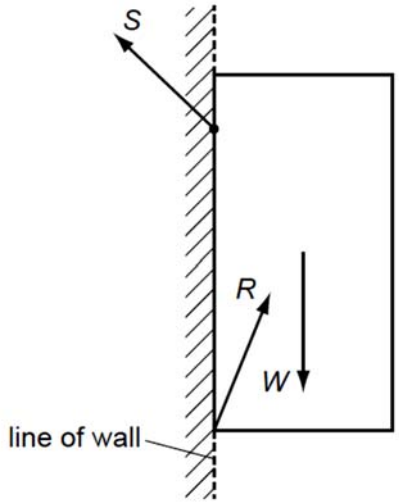
9 A cupboard is attached to a wall by a screw.

Which force diagram shows the cupboard in equilibrium, with the weight W of the cupboard, the force S that the screw exerts on the cupboard and the force R that the wall exerts on the cupboard?

A



B



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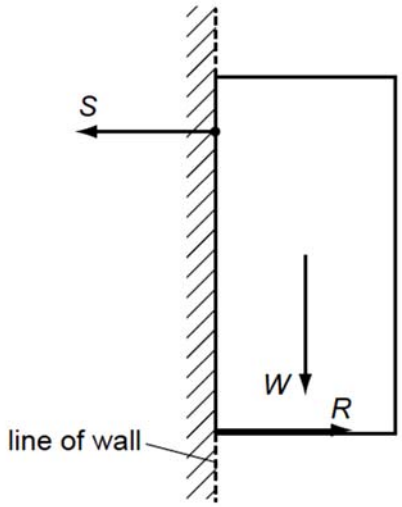

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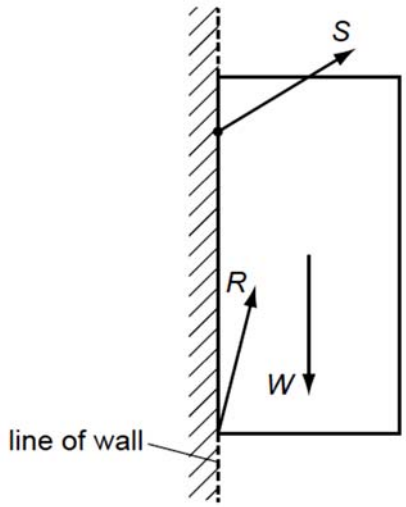
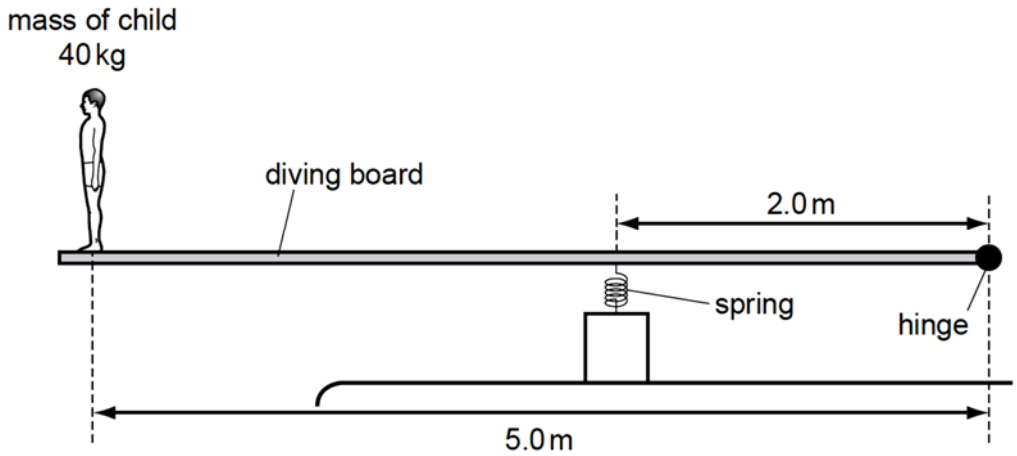


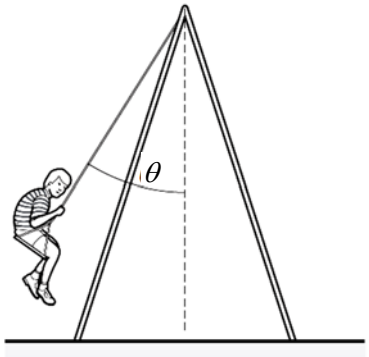
10 A diving board of length 5.0 m is hinged at one end and supported 2.0 m from this end by a spring of spring constant 10 kN m^{-1}. A child of mass 40 kg stands at the far end of the board.



What is the extra compression of the spring caused by the child standing on the end of the board?

A 1.0 cm **B** 1.6 cm **C** 9.8 cm **D** 16 cm

11 A child of mass 50 kg is on a swing which is suspended by 4.0 m ropes from a rigid support. The horizontal speed of the swing as it passes through the lowest point is 3.0 m s^{-1}.



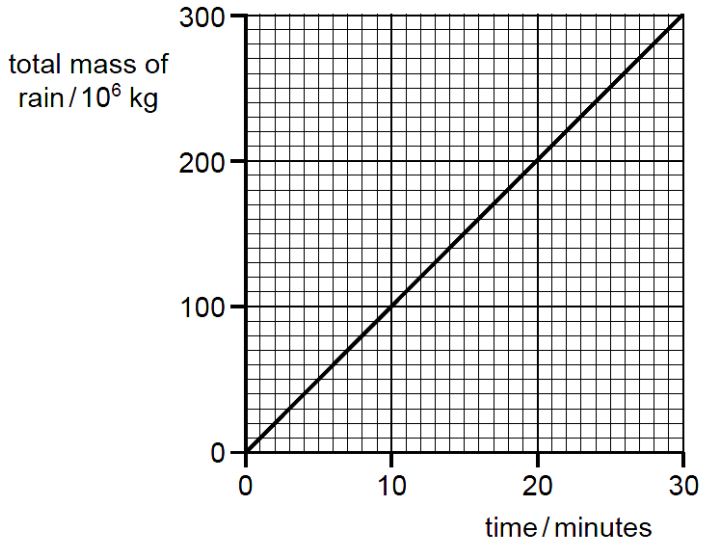
What is the angle θ that the rope makes with the vertical when the swing is at its highest point?

A 28° **B** 40° **C** 42° **D** 62°

12 A motor of 10 W is used to lift a load of 20 N. The efficiency of the motor is 25 %. How long does it take to lift the load through a vertical distance of 0.50 m?

A 0.25 s **B** 2.5 s **C** 4.0 s **D** 39 s

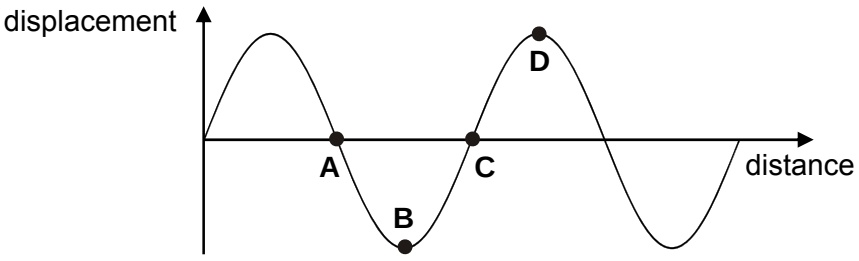
13 Rain from a thunderstorm reaches the ground at a speed of 12 m s^{-1}. The graph shows how the total mass of deposited rain increases with time.



What is the average power delivered by the rain as it hits the ground?

A 1.0 x 10^6 W **B** 1.2 x 10^7 W **C** 2.4 x 10^7 W **D** 7.2 x 10^8 W

14 A sound wave travelling towards the right through air causes the air molecules to be displaced from their equilibrium positions. The graph below shows the variation with distance of the displacement of air molecules at a particular instant of time.



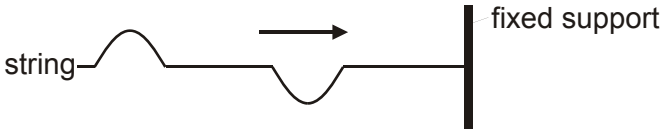
Taking the displacement towards the right as positive, which is a point of rarefaction?

15 Two coherent waves, of intensities I and $9I$, meet at a point with a phase difference of 540^0.

What is the resultant intensity at that point?

A $4I$ **B** $8I$ **C** $10I$ **D** $16I$

16 A string is held horizontally with one end attached to a fixed support. Two pulses are created at the free end of the string. The pulses are moving towards the fixed support as shown in the diagram below.

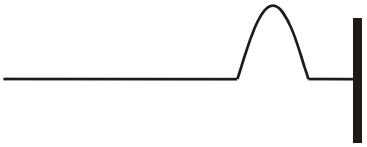


Which one of the following diagrams is a possible subsequent picture of the string?

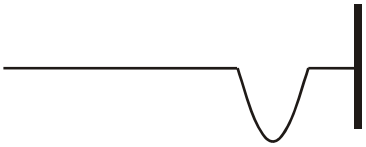
A

B

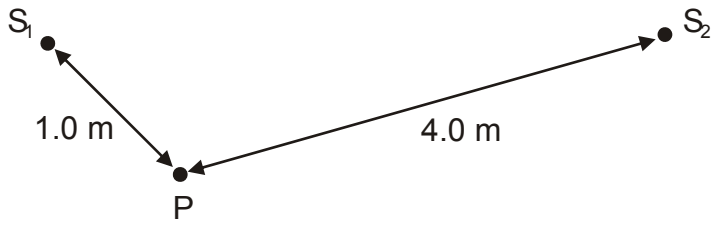
C



D



17 Water waves of wavelength 2.0 m are produced by two sources S_1 and S_2. The sources vibrate in anti-phase.



Point P is 1.0 m from S_1 and 4.0 m from S_2. S_1 alone and S_2 alone each produces a wave of amplitude *a* and 2*a* at P respectively. Which one of the following is the amplitude of the resultant wave at point P when S_1 and S_2 are both emitting waves?

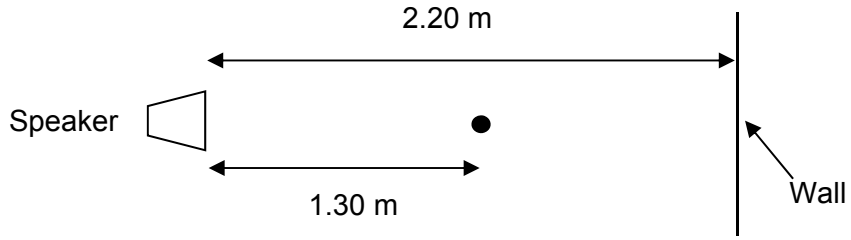
A zero **B** *a* **C** 3*a* **D** 9*a*

18 In a Young's double slit experiment, when light of a wavelength of 4.5×10^{-7} m is shone through the slits which are separated by 1.4 mm, a fringe pattern with a fringe separation of 7.0×10^{-4} m is obtained.

What would be the fringe separation if light of wavelength 6.5×10^{-7} m is shone through slits which are separated by 0.50 mm?

A 1.7×10^{-4} m **B** 3.6×10^{-4} m **C** 1.4×10^{-3} m **D** 2.8×10^{-3} m

19 A student places a speaker 2.20 m from a wall. It emits a sound wave of wavelength 0.50 m towards the wall. The wave gets reflected and interferes with the incoming wave from the speaker. A microphone connected to a CRO is placed 1.30 m from the speaker.



The student wishes to obtain a constant amplitude on the CRO, but is unable to do so. What is the reason for this?

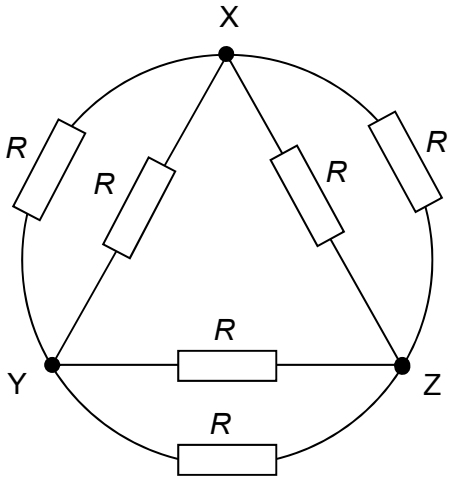
A The distance between the speaker and the wall is of the wrong value.

B The wall absorbs some of the sound energy.

C The microphone is not placed at the node.

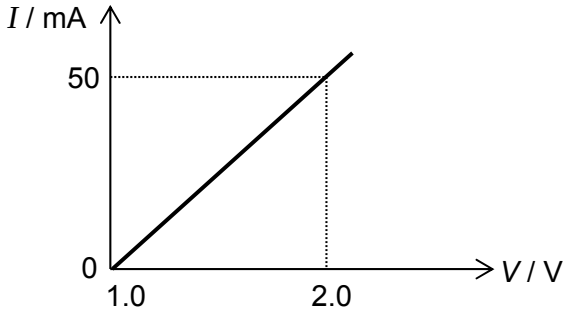
D The microphone is not placed at the antinode.

20 The given circuit is made up of six resistors each of resistance *R*. What is the equivalent resistance across X and Y?



A $6R$ **B** $2R$ **C** R **D** $\frac{1}{3}R$

21 The graph below shows the relation between the direct current I in a certain conductor and the potential difference V across it. When V is less than 1.0 V, the current is negligible.



Which statement about the conductor is correct?

A It does not obey Ohm's law but when V = 1.5 V, resistance = 20 Ω

B It does not obey Ohm's law but when V = 1.5 V, resistance = 60 Ω

C It obeys Ohm's law and when V = 1.5 V, resistance = 20 Ω

D It obeys Ohm's law and when V = 1.5 V, resistance = 60 Ω

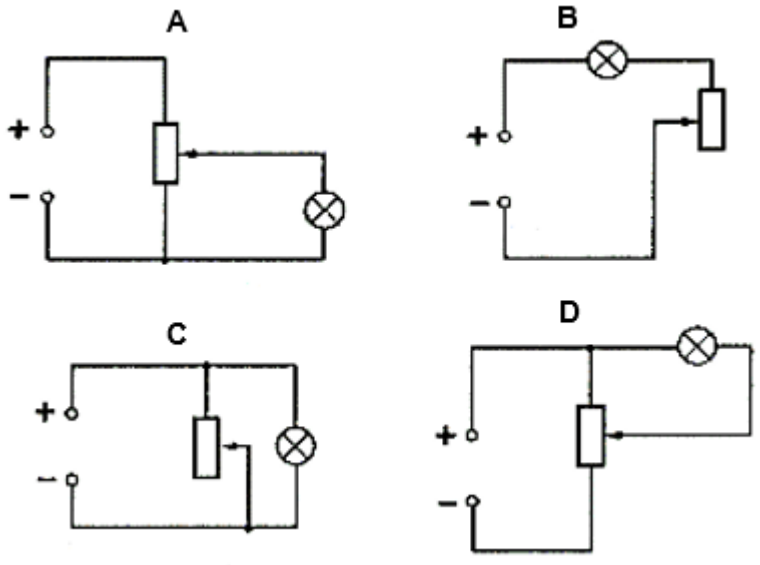
22 The potential difference between point X and point Y is 20 V. The time taken for charge carriers to move from X to Y is 15 s and in this time the energy of the charge carriers changes by 12 J.

What is the current between X and Y?

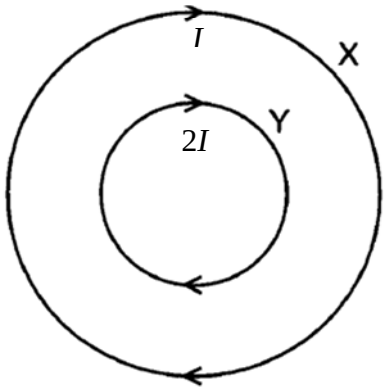
A 0.040 A **B** 0.11 A **C** 9.0 A **D** 25 A

23 A lamp is connected to a power supply of negligible resistance.

Which circuit could **not** be used as a practical means to vary the voltage across the lamp?



24 Two concentric coils X and Y each carries a current in the same direction as shown below.



Which of the following statements is correct?

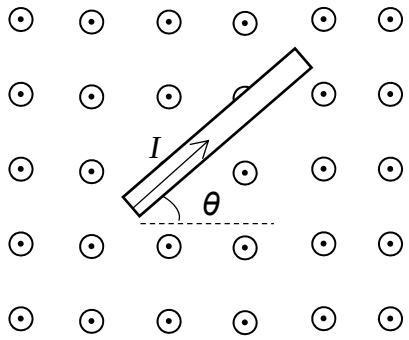
A Force due to current in Y on X is twice that due to X on Y and is inward on X.

B Force due to current in Y on X is twice that due to X on Y and is perpendicular to the plane of the coil X.

C The direction of the force acting on every point of Y is radially inwards, towards the centre of Y.

D The direction of the force acting on every point of Y is radially outwards, away from the centre of Y.

25 A wire of length 3.5 cm is placed on a vertical plane in a region of magnetic field. Uniform magnetic field of flux density 0.080 T is directed out of the plane as shown. The wire makes an angle θ with the horizontal and carries a current I of 4.0 A in the direction as shown.



Which of the following is true about the magnitude of the force which the field exerts on the wire at different angles of θ from 0° to 360°? (Assume that the rod remains in the magnetic field throughout)

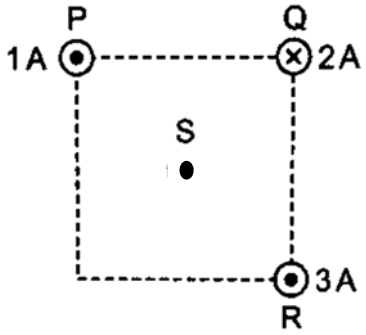
A The force is constant at 0 N.

B The force varies between 0 N and 0.0112 N.

C The force is constant at 0.0112 N.

D The force varies between 0.0112 N and 0.0224 N.

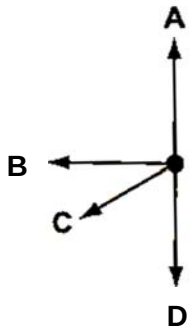
26 The diagram below shows a horizontal plane through which three long straight vertical wires pass.



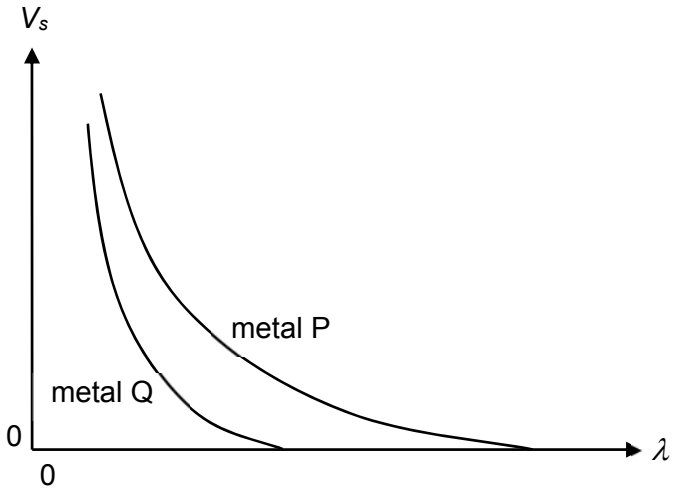
Wires P, Q and R are at three corners of a square and point S is at the centre.

Wire P carries a current of 1 A out of the paper. Wire Q carries 2 A into the paper. Wire R carries 3 A out of the paper.

Which one of the arrows below shows the direction of the magnetic flux density at point S?



27 The figure below shows the variation of stopping potential V_s with the wavelength of the radiation λ incident on 2 different metals, P & Q.



Which of the following statements is correct?

A A higher frequency light is required to produce photoelectric effect in metal Q than in P.

B The work function of metal P is higher than Q.

C The intensity of light incident on metal P is higher than that on Q.

D The gradient of the tangent to the curve gives the value of the Planck constant.

28 When light of frequency f_1 is shone on to a metal surface, the maximum energy of the electrons emitted is E_1. If the same surface is illuminated with light of frequency f_2, the maximum energy of the electrons emitted is E_2.

Which of the following shows the expression for the Planck's constant?

A $\frac{f_2E_1 + f_1E_2}{f_1f_2}$ **B** $\frac{f_2E_1 - f_1E_2}{f_1f_2}$ **C** $\frac{E_1 + E_2}{f_1 + f_2}$ **D** $\frac{E_1 - E_2}{f_1 - f_2}$

29 Which of the following statements is true?

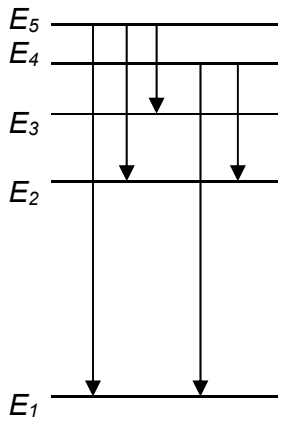
A A beam of electrons directed at a vessel of cold gas can cause the formation of either an absorption or emission line spectrum.

B A beam of white light directed at a vessel of cold gas can only cause the formation of an absorption line spectrum.

C A beam of electrons directed at a vessel of cold gas can only cause the formation of an absorption line spectrum.

D A beam of electrons directed at a vessel of cold gas can only cause the formation of an emission line spectrum.

30 The figure below shows five energy levels of an atom. Five transitions between the levels are indicated, each of which produces a photon of definite energy.



Which of the following spectra best corresponds to the set of transitions indicated above?