INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE NAME			
CLASS		INDEX NUMBER	

PHYSICS 8866/01

Paper 1 Multiple Choice **24 September 2014**

1 hour

Additional Materials: Multiple choice answer sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, civics group and index number on the Answer sheet in the spaces provided unless this has been done for you.

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 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.

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 The ideal gas law can be expressed in the equation

$$PV = nRT$$

where P is the absolute pressure of the gas, V is the volume of the gas, n is the amount of substance of gas (measured in moles), R is the molar gas constant, and T is the absolute temperature of the gas. Which one of the following is the SI base unit for R?

A $J\ K^{-1}\ mol^{-1}$ **B** $kg\ m^2\ K^{-1}\ mol^{-1}\ s^{-2}$

C $kg^2\ m^3\ K\ mol^{-1}\ s^{-2}$ **D** $Pa\ m^3\ K^{-1}\ mol^{-1}$

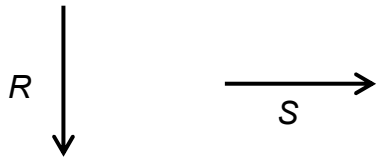
2 In a simple electrical circuit, the current in a resistor is measured as (3.50 ± 0.05) mA.

The resistor is marked as having a value of $4.3\ \Omega \pm 2\%$.

If these values were used to calculate the power dissipated in the resistor, what would be the percentage uncertainty in the value obtained?

A 3% **B** 4% **C** 5% **D** 6%

3 The vectors R and S are shown below. They have the same magnitude.



Which row shows the correct vector for ($R + S$) and ($R - S$) respectively?

	$R + S$	$R - S$
A	↙	↗
B	↙	↘
C	↘	↙
D	↘	↗

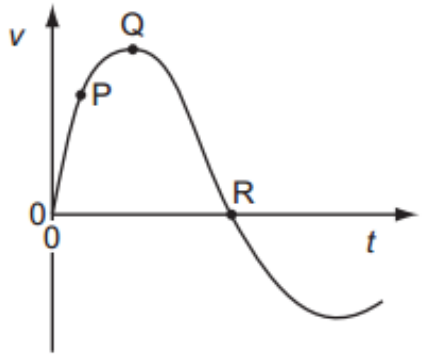
4 A ball, when thrown vertically upward in an **evacuated tube** on earth with an initial speed of u, returns to the point of throw with a speed of u after t.

The same ball is thrown vertically upward **in air** on earth with the same initial speed u.

Which of the following correctly describes the speed of this ball when it returns to the point of throw and the time taken to do so?

	speed of ball	time taken
A	less than u	less than t
B	less than u	more than t
C	more than u	less than t
D	more than u	more than t

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



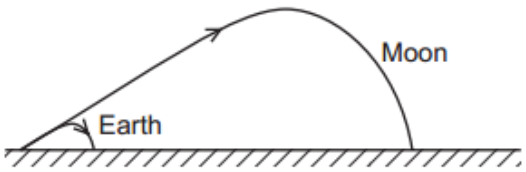
At which point is the bungee jumper momentarily at rest and at which point does she have zero acceleration?

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

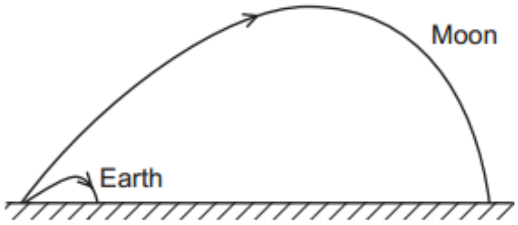
6 A golf ball is hit with the same force and direction on the Earth and on the Moon.

Which diagram best represents the shapes of the paths taken by the golf ball?

A



B



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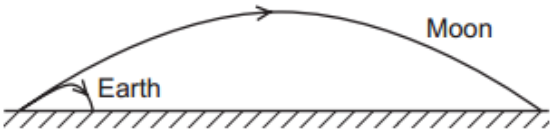
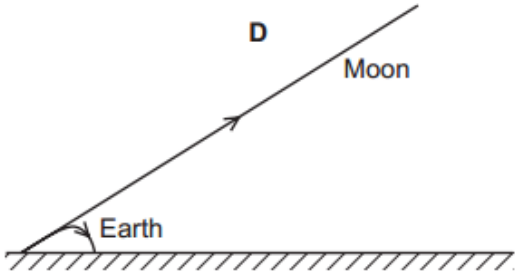


D



7 A projectile is launched at an angle of 30° to the horizontal. Its initial kinetic energy is *E*.

If air resistance is negligible, what is the projectile's kinetic energy at the highest point of motion?

A zero **B** 0.50 *E* **C** 0.75 *E* **D** *E*

8 A tennis ball approaches a tennis player who gives it a hard hit with a swing of his racket, returning the ball to his opponent.

During the time of contact between the racket and the ball,

A the force on the racket due to the ball is smaller than the force on the ball due to the racket because the ball is much smaller and lighter than the racket.

B the force on the racket due to the ball is smaller than the force on the ball due to the racket because the ball moves off with high speed after the contact whereas the racket does not.

C the force on the racket due to the ball is larger than the force on the ball due to the racket because smaller mass means smaller force.

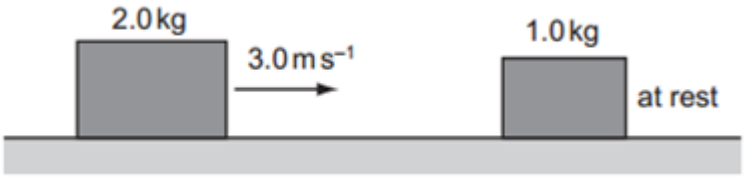
D the force on the racket due to the ball is equal to the force on the ball due to the racket.

9 A car of mass 750 kg has a horizontal driving force of 2.0 kN acting on it. It has a forward horizontal acceleration of 2.0 m s^{-2}.

What is the resistive force acting horizontally?

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

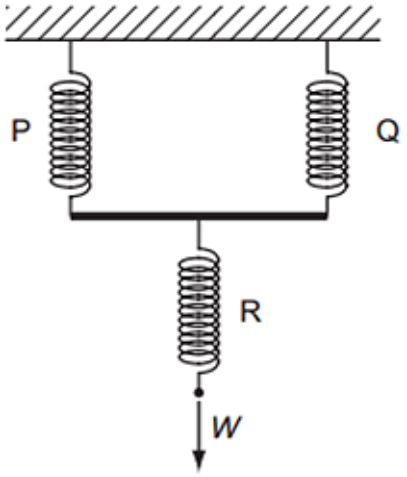
10 A 2.0 kg mass travelling at 3.0 m s^{-1} on a frictionless surface collides head-on with a stationary 1.0 kg mass. The masses stick together on impact.



How much energy is lost on impact?

A zero **B** 2.0 J **C** 2.4 J **D** 3.0 J

11 Three springs are arranged vertically as shown.



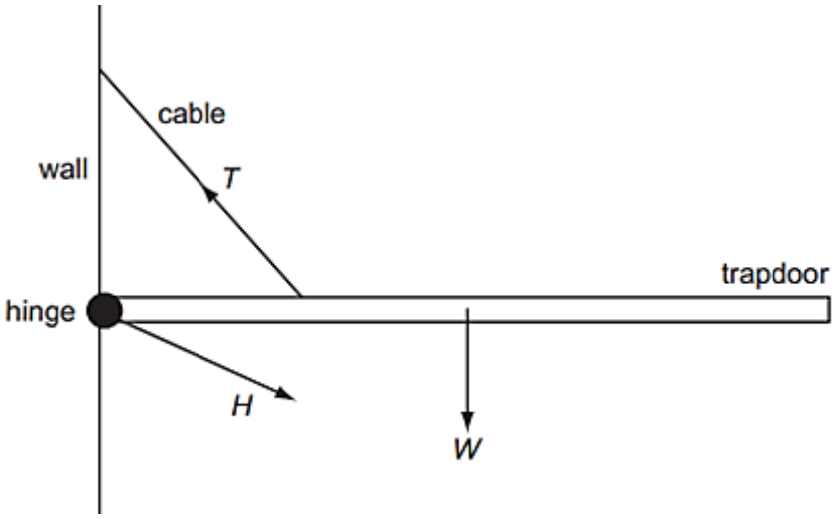
Springs P and Q are identical and have spring constant k. Spring R has spring constant $3k$.

What is the increase in the overall length of the arrangement when a force W is applied as shown?

A $\frac{5W}{6k}$ **B** $\frac{4W}{3k}$ **C** $\frac{7kW}{2}$ **D** $4kW$

12 A hinged trapdoor is held closed in the horizontal position by a cable.

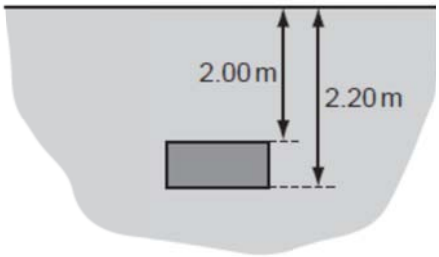
Three forces act on the trapdoor: the weight *W* of the door, the tension *T* in the cable and the force *H* at the hinge.



Which list gives the three forces in **increasing** order of magnitude?

A *H, T, W* **B** *T, H, W* **C** *W, H, T* **D** *W, T, H*

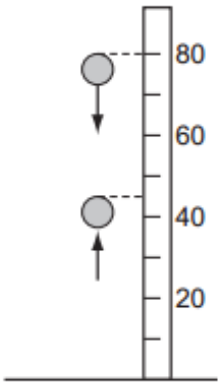
13 The diagram shows a rectangular block of mass 8.2 kg immersed in sea water of density 1100 kg m^{-3}. The area of the top and bottom surfaces of the block is 0.50 m^2.



What is the difference in pressure between the top and bottom surfaces of the block?

A 2.2×10^2 Pa **B** 1.1×10^3 Pa **C** 2.2×10^3 Pa **D** 2.3×10^4 Pa

14 A solid rubber ball has a diameter of 8.0 cm. It is released from rest with the top of the ball 80 cm above a horizontal surface. It falls vertically and then bounces back up so that the maximum height reached by the top of the ball is 45 cm, as shown.



If the kinetic energy of the ball is 0.75 J just before it strikes the surface, what is its kinetic energy just after it leaves the surface?

A 0.36 J **B** 0.39 J **C** 0.40 J **D** 0.42 J

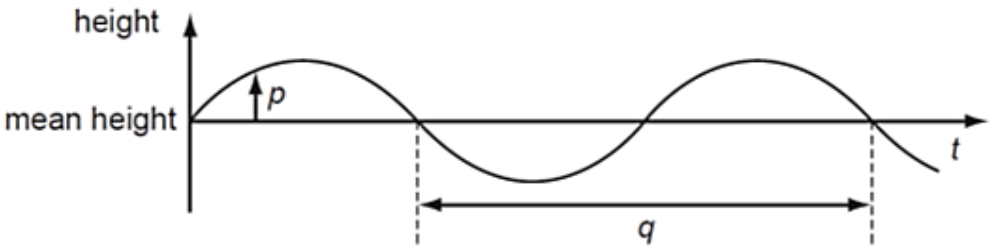
15 A crane is being used to lift containers off a ship. One container has a mass of 14000 kg and is being lifted vertically with a speed of 3.2 m s^{-1}.

The electric motor being used to supply the power to lift the container is using a current of 240 A at a potential difference of 2200 V.

What is the efficiency of the system?

A 8.1 % **B** 8.5 % **C** 48 % **D** 83%

16. The graph shows how the height of the water surface at a point in a harbour varies with time *t* as waves pass the point.



What are *p* and *q*?

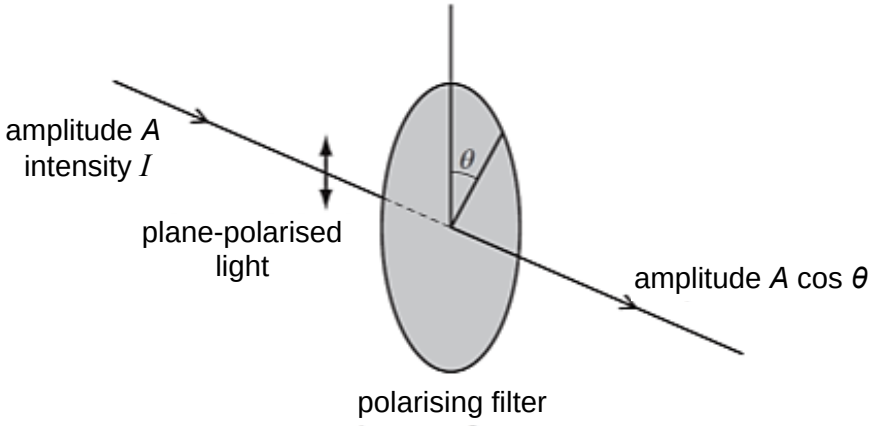
	p	*q*
A	displacement	period
B	displacement	wavelength
C	amplitude	period
D	amplitude	wavelength

17 X and Y are two points on the surface of water in a ripple tank. A source of waves of constant frequency begins to generate waves which then travel past X and Y, causing them to oscillate.

What is the phase difference between X and Y?

A 45° **B** 135° **C** 180° **D** 270°

18 When plane-polarised light of amplitude *A* is passed through a polarising filter as shown, the amplitude of the light emerging is $A\cos\theta$.



The intensity of the initial beam is I.

What is the intensity of the emerging light when θ is 60°?

A 0.25 I **B** 0.50 I **C** 0.75 I **D** 0.87 I

19 Diffraction can be observed when a wave passes an obstruction.

For waves travelling through air, what is the combination of wave and obstruction that could best demonstrate diffraction?

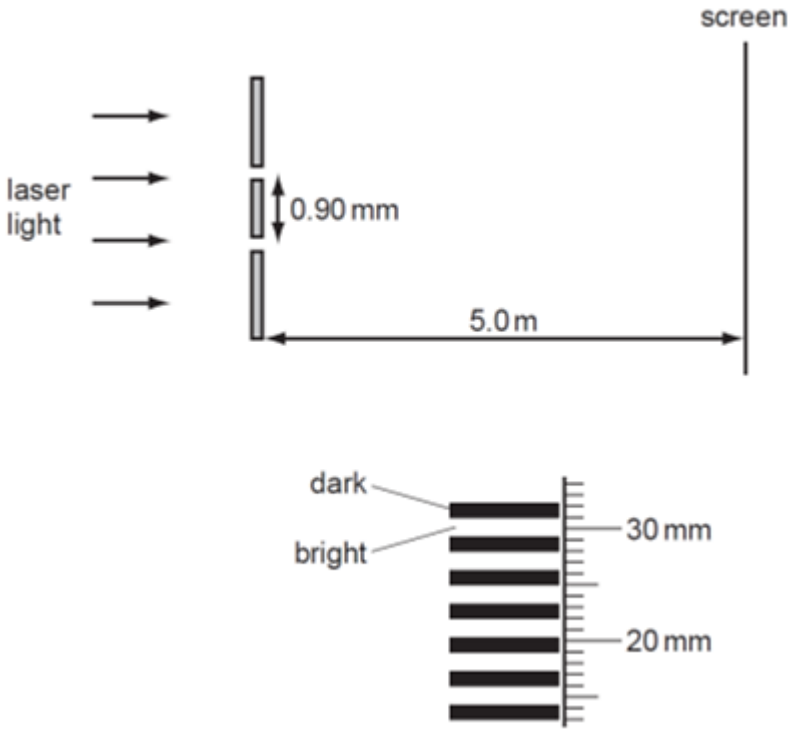
A microwaves passing a steel post

B radio waves passing a copper wire

C sound waves passing a human hair

D visible light waves passing a gate post

20 The diagrams show the arrangement of apparatus for a Young's double slits experiment and also part of the pattern formed on the screen with a ruler placed next to it.



What is the wavelength of the light?

A 4.8×10^{-7} m **B** 5.4×10^{-7} m **C** 3.2×10^{-6} m **D** 3.4×10^{-6} m

21 In an electrical circuit, two materials P and Q of circular cross section have the same length. The resistivity of material P is double that of material Q.

What is the ratio of $\frac{\text{diameter P}}{\text{diameter Q}}$ for both the material to have the same resistance?

A $\frac{1}{\sqrt{2}}$ **B** 1 **C** $\sqrt{2}$ **D** 2

22 What physical quantity would be the result of multiplying a potential difference with an electric charge?

A Electric current **B** Electric potential energy

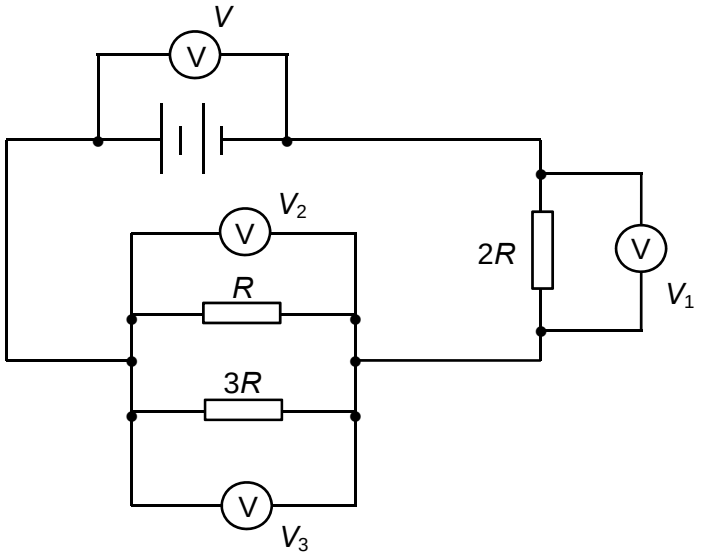
C Electric power **D** Electromotive force

23 A filament lamp is rated at 40 W and 5.0 V.

What is the number of electrons passing through the lamp in 1.0 s when it is operated at its rated condition?

A 5.0×10^{19} **B** 6.0×10^{19} **C** 8.5×10^{19} **D** 25×10^{19}

24 The figure below shows a circuit with four voltmeter readings V, V_1, V_2 and V_3.



Which equation relating the voltmeter readings is true?

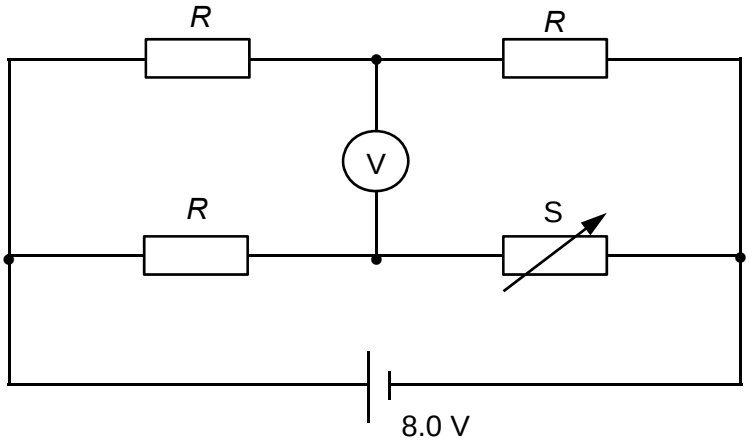
A $V = V_1 + V_2 + V_3$

B $V - V_3 = V_1$

C $V + V_3 = V_1 + V_2$

D $V_3 = 3(V_2)$

25 A battery of e.m.f. 8.0 V and negligible internal resistance is connected to three fixed resistors, each of resistance R and a variable resistor S as shown in the diagram. The voltmeter has infinite resistance.

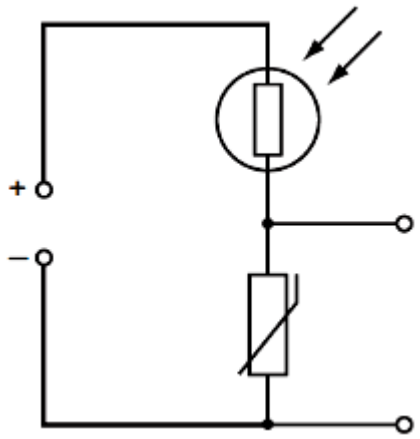


The resistance of S changes from R to $3R$.

What is the change in the reading of the voltmeter?

A zero **B** 2.0 V **C** 4.0 V **D** 6.0 V

26 A potential divider circuit is formed using a light-dependent resistor (LDR) and a thermistor as shown in the following diagram.

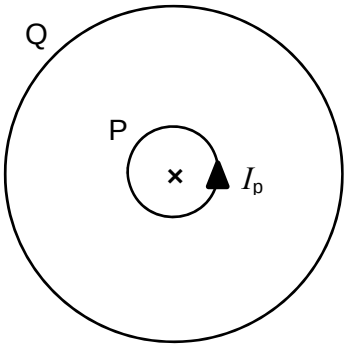


Under which set of conditions will the potential difference across the thermistor have the smallest value?

	illumination	temperature
A	low	low
B	low	high
C	high	low
D	high	high

27 The magnetic flux density at the center of a flat circular coil is proportional to the number of turns and current in the coil and inversely proportional to its radius. The diagram show two circular coils P and Q lying in the same plane and are concentric.

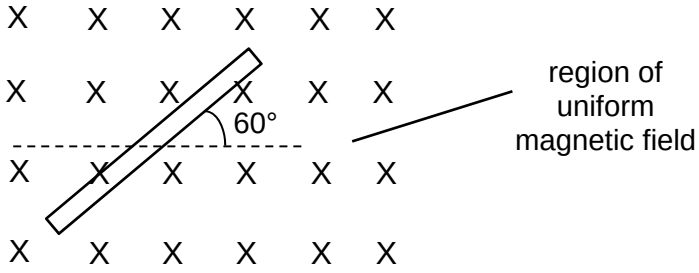
Coil P of radius 4.0 cm has 10 turns and carries a current I_p of 2.0 A. Coil Q of radius 16.0 cm has 40 turns. The current in coil Q is adjusted such that the resultant magnetic field at the common center X is zero.



Which is the magnitude and direction of the current in coil Q?

	magnitude of current	direction of current
A	0.5 A	clockwise
B	1.0 A	anti-clockwise
C	2.0 A	clockwise
D	4.0 A	anti-clockwise

28 The diagram shows a 4.0 cm straight conductor carrying a current of 5.0 A, and placed in a region of uniform magnetic field of flux density 0.040 T.



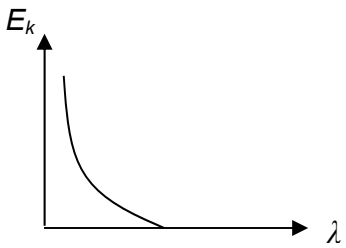
What is the magnitude of the force acting on the conductor?

A 4.0×10^{-3} N **B** 6.0×10^{-3} N **C** 7.0×10^{-3} N **D** 8.0×10^{-3} N

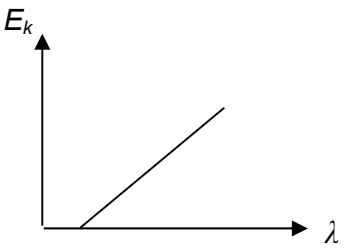
29 The maximum kinetic energy E_k of emitted electrons is measured in photoelectric experiments using light of particular intensity.

Which of the following is a possible graph showing how the maximum kinetic energy E_k varies with the wavelength λ of the light?

A



B



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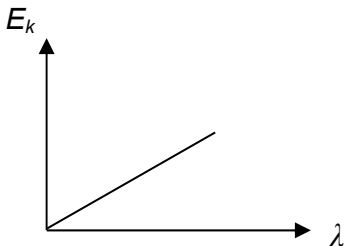

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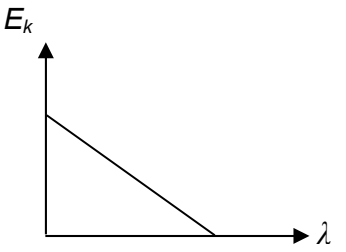

30 Transitions between three energy levels in a particular atom give rise to three spectral lines. The shortest and longest wavelengths of these spectral lines are λ_1 and λ_2 respectively. What is the wavelength of the other spectral line?

A $\lambda_2 - \lambda_1$ **B** $\dfrac{\lambda_2 - \lambda_1}{2}$ **C** $\dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$ **D** $\dfrac{\lambda_1 \lambda_2}{\lambda_2 - \lambda_1}$

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