

PDG

Candidate Name _____

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ANDERSON JUNIOR COLLEGE

2009 JC2 Preliminary Examination

PHYSICS

8866/01

Higher 1

Paper 1 Multiple Choice

Tuesday 22 September 2009

1 hour

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name and PDG on the spaces provided above.

Write your name and PDG on the Multiple Choice Answer Sheet.

Shade the 7 digits of 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 Multiple Choice 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 booklet.

Data

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

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,	$R = R_1 + R_2 + \dots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \dots$

- 1 In the determination of the electro-chemical equivalent of copper, z , by electrolysis, the following equation is employed: $z = \frac{m_1 - m_2}{It}$ where

$$m_1 = (24.78 \pm 0.01) \times 10^{-3} \text{ kg}$$

$$m_2 = (20.91 \pm 0.01) \times 10^{-3} \text{ kg}$$

$$I = (3.00 \pm 0.05) \text{ A}$$

$$t = (7400 \pm 1) \text{ s}$$

The value of z calculated from these readings will have an error of at most

- A 1.7% B 1.8% C 1.9% D 2.2%
- 2 The estimated number of ping pong balls that can completely fill a classroom of a dimension 20.0 m by 10.0 m by 3.50 m, without being crushed is
- A 10^3 B 10^6 C 10^7 D 10^8
- 3 An object of mass 1.000 kg is placed on four different balances. For each balance the reading is taken five times.

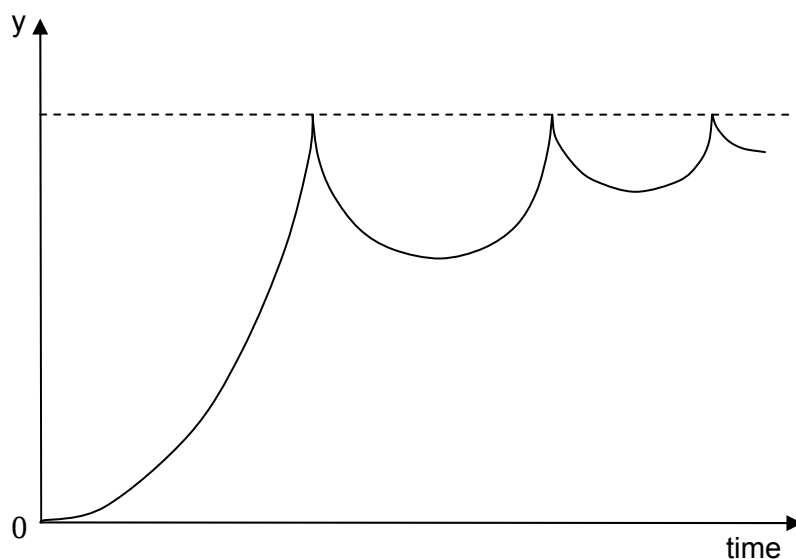
The table shows the values obtained together with the means.

Which balance has the smallest systematic error but is not very precise?

balance	reading / kg					mean / kg
	1	2	3	4	5	
A	1.000	1.000	1.002	1.001	1.002	1.001
B	1.011	0.989	1.001	0.995	0.999	0.999
C	1.012	1.013	1.012	1.014	1.014	1.013
D	0.993	0.987	1.002	1.000	0.983	0.993

- 4 A man kicks a rock horizontally off a cliff of height 40.0 m into a pool of water below. If he hears the sound of splash 3.00 s after he kicked the rock, find the initial speed of the rock. Assume speed of sound in air to be 343 m s^{-1} .
- A 10.2 m s^{-1} B 13.3 m s^{-1} C 17.3 m s^{-1} D 343 m s^{-1}

- 5 The sketch below describes the motion of an object rebounding from a horizontal surface after being released from a point above the surface.



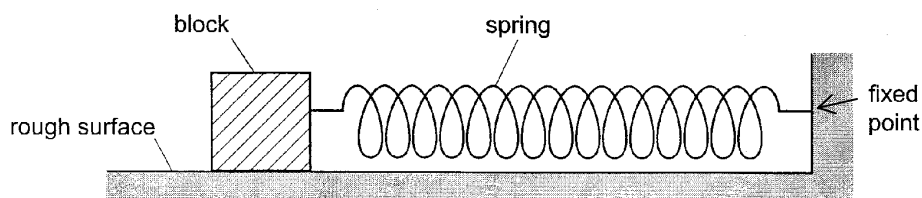
The quantity represented on the y-axis is the ball's

- A displacement B velocity C acceleration D momentum
- 6 A car travelling at speed u comes to a complete halt after a distance s when the driver applies a uniform braking force. A second car, travelling at speed $2u$, comes to a halt when the driver applies a uniform braking force with twice the magnitude to that of the first car.

What is the distance for the second car to come to a halt? You may ignore the reaction time of the driver.

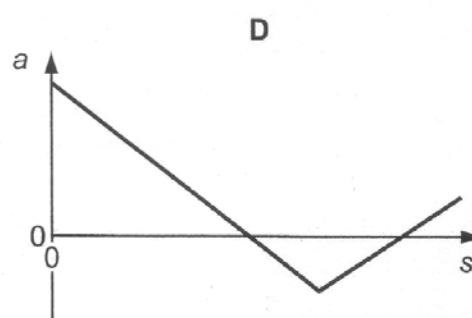
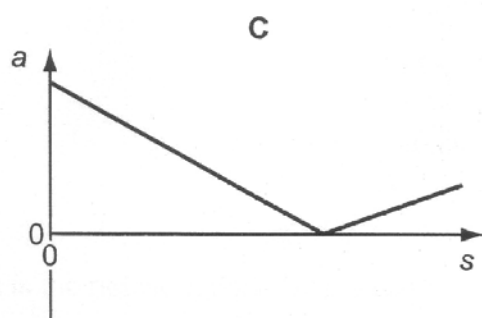
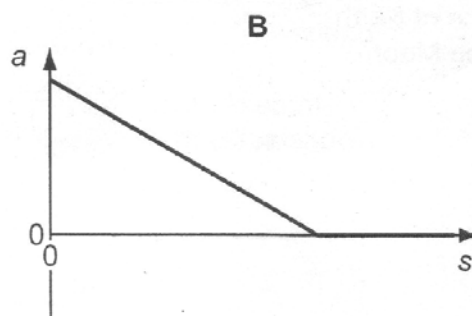
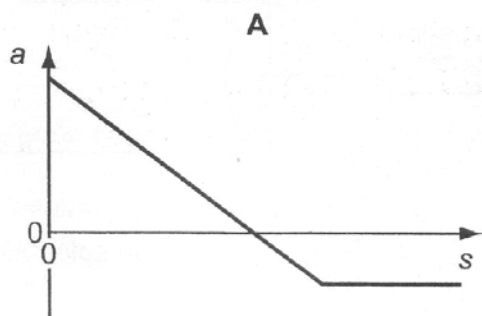
- A $\frac{1}{2}s$ B s C $2s$ D $4s$

- 7 One end of a light spring is attached to a fixed point and the other end to a block that rests on a rough, horizontal surface that provides a constant source of friction.

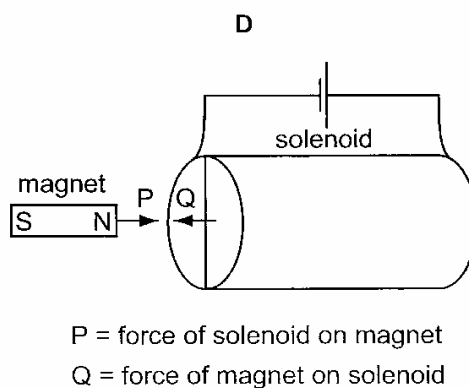
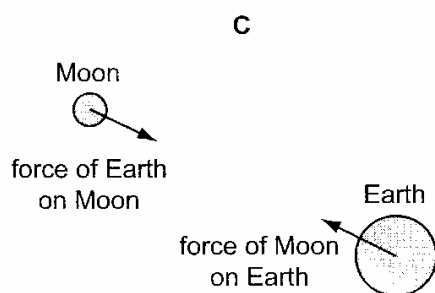
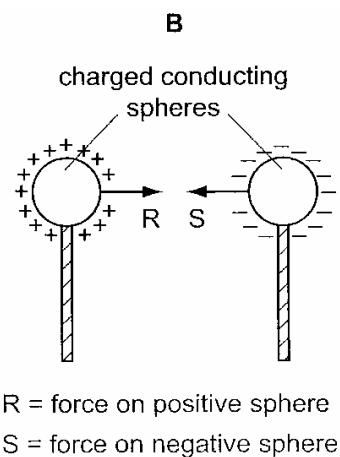
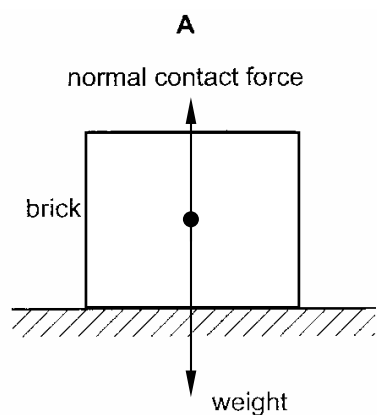


The spring obeys Hooke's law when under tension but does not provide any compressive force. The block is pulled and the spring is stretched. At the position where the block is released, the displacement is zero.

Which graph shows the variation with displacement s of the acceleration a of the block?

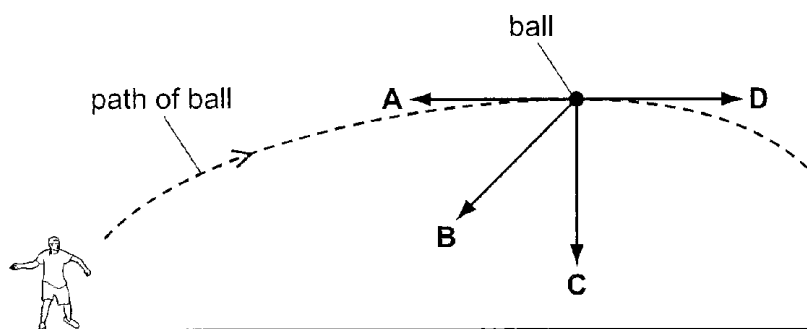


- 8 Which diagram shows a pair of forces that are **not** related to one another by Newton's third law?

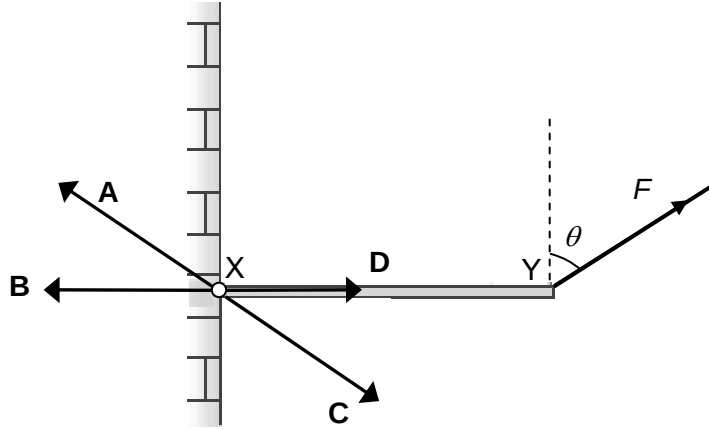


- 9 The diagram shows a ball which has been thrown and is being acted on by air resistance.

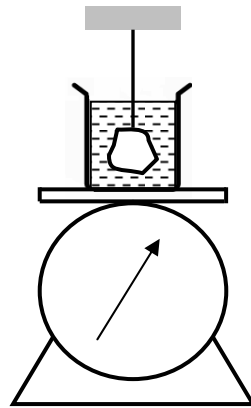
Which labelled arrow shows the direction of the resultant force on the ball when it is at the position shown?



- 10 A uniform rod XY is freely hinged to the wall at X. It is held horizontal by a force F acting from Y at an angle θ to the vertical as shown in the diagram. Which arrow shows the direction of the reaction force exerted by the wall on the rod?



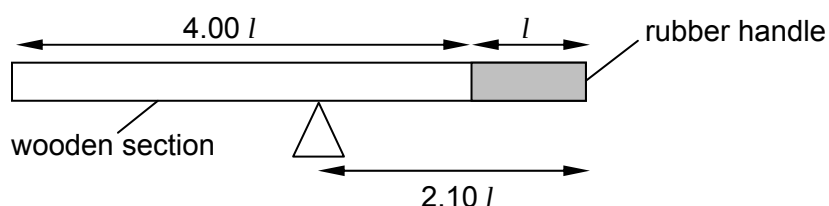
- 11 When a beaker of water rests on a balance, the weight indicated is X . A solid object of weight Y in air displaces weight Z of water when immersed.



What will be the balance reading when the object is suspended in the beaker of water so that it is totally immersed as shown in the diagram above?

- A X B $X + Z$ C $X + Y$ D $X + Y - Z$

- 12 A uniform rod has a wooden section and a solid rubber handle, as shown.



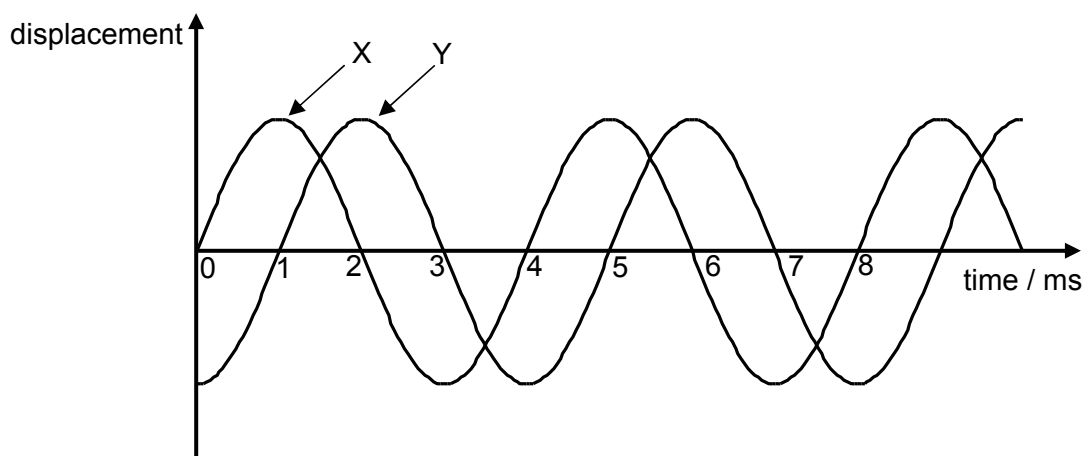
The length of the handle is l and the length of the wooden section is $4.00 l$. The rod balances a distance $2.10 l$ from the rubber end.

What is the ratio $\frac{\text{density of rubber}}{\text{density of wood}}$?

- A 1.71 B 2.25 C 2.50 D 3.27
- 13 A 1.0 kg ball is released from a certain height. When it is 0.70 m above the floor, its potential energy is exactly equal to its kinetic energy. The speed of the ball just before it hits the floor is
- A 3.7 m s^{-1} B 5.2 m s^{-1} C 14 m s^{-1} D 27 m s^{-1}
- 14 A car of mass m is accelerated horizontally from rest to a speed v by a constant force F . How much work is done on the car during this acceleration?
- A $\frac{1}{2} Fv$ B Fv C mv D $\frac{1}{2} m v^2$
- 15 A small metal sphere of mass m is moving through a viscous liquid. When it reaches a constant downward velocity v , which of the following describes the changes with time in the kinetic energy and gravitational potential energy of the sphere?

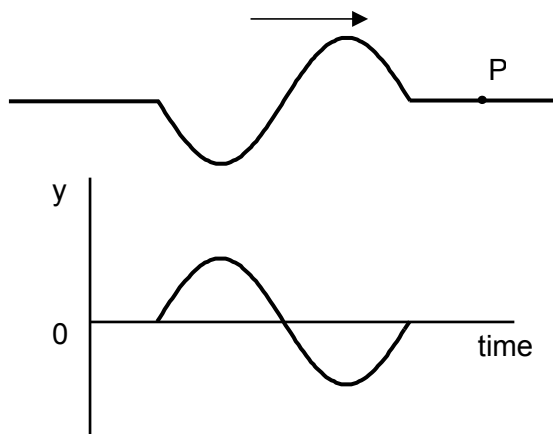
	kinetic energy	gravitational potential energy
A	constant and equal to $\frac{1}{2} mv^2$	decreases at a rate of mgv
B	constant and equal to $\frac{1}{2} mv^2$	decreases at a rate of $(mgv - \frac{1}{2} mv^2)$
C	increases at a rate of mgv	decreases at a rate of mgv
D	increases at a rate of mgv	decreases at a rate of $(\frac{1}{2} mv^2 - mgv)$

- 16 The diagram shows the displacement-time graphs for two waveforms X and Y.



What is the phase difference between X and Y?

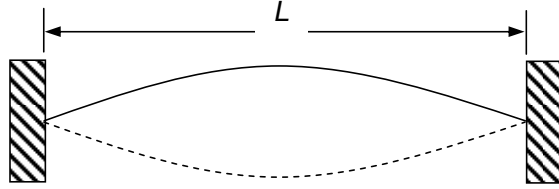
- A 1 ms B 0.8 ms C $\pi/4$ radians D $\pi/2$ radians
- 17 The diagram shows the profile of a pulse on a string traveling towards a point P. The graph shows the variation with time of a physical quantity measured at P while the pulse is passing.



Which one of the following quantities does the y-axis represent?

- A displacement B velocity C acceleration D potential energy

- 18 A wire of length L is stretched between two supports and plucked. The speed of transverse waves on the wire is c .

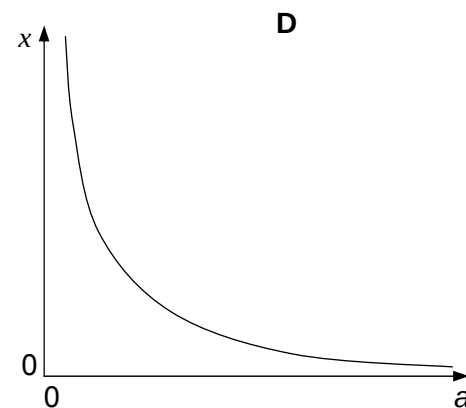
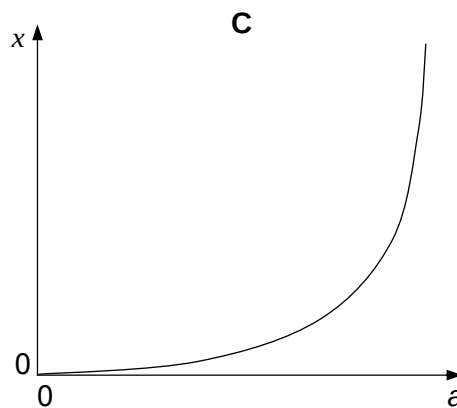
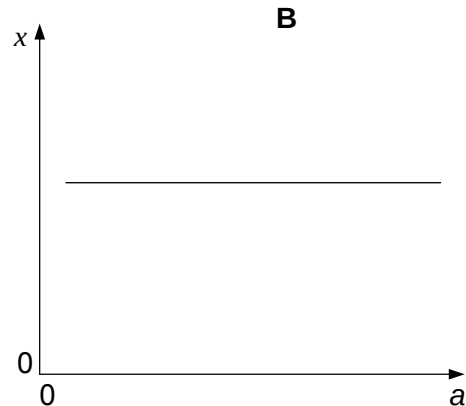
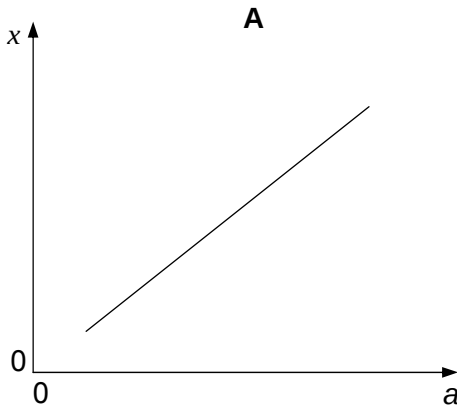


Which one of the following expressions, in which n has integral values 1, 2, 3, ... etc, will give the frequencies of **all** stationary waves which can form on the wire?

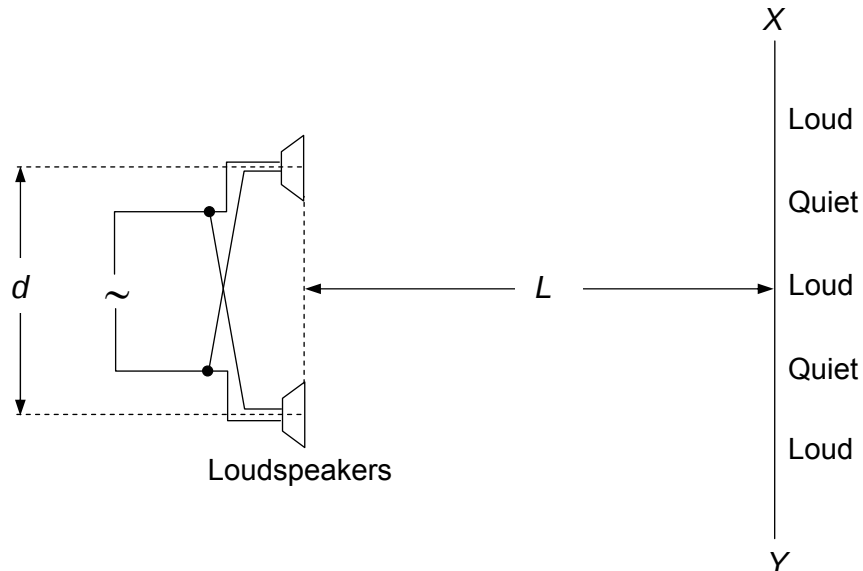
- A $\frac{nc}{L}$ B $\frac{nc}{2L}$ C $\frac{2nc}{L}$ D $\frac{(n+1)c}{2L}$

- 19 Interference fringes are produced by the Young's double slit experiment using monochromatic light.

Which one of the following graphs correctly shows the relationship between fringe spacing x and slit separation a ?



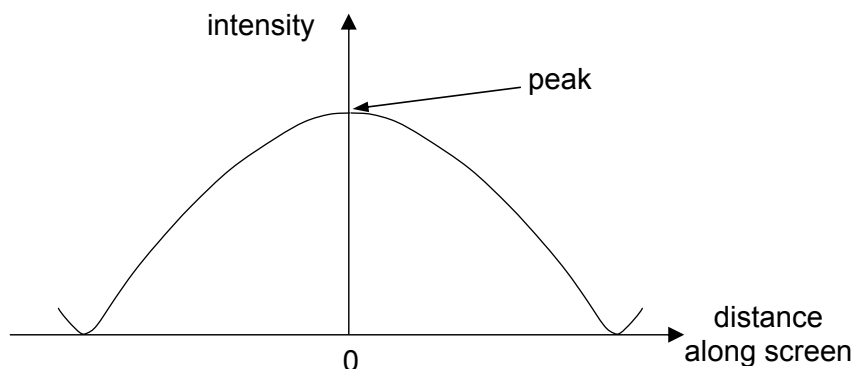
- 20 The diagram shows two identical loudspeakers driven in phase from a common audio-frequency source.



When a student moves along a line such as XY he notices that there are regions in which the sound heard is alternately loud and quiet. Regions in which the sound is loud may be moved closer together by

- A decreasing distance d
- B increasing L
- C increasing the frequency of the audio-frequency source
- D increasing the power output from the audio-frequency source

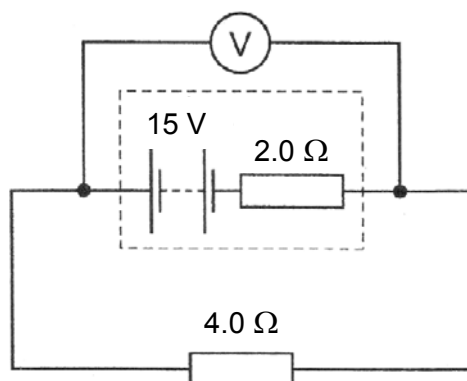
- 21 Monochromatic light incident on an adjustable single slit produces on a screen a distribution represented by the figure below.



What happen to the intensity of the peak and the width of the pattern when the width of the slit is reduced?

	intensity of peak	width of pattern
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

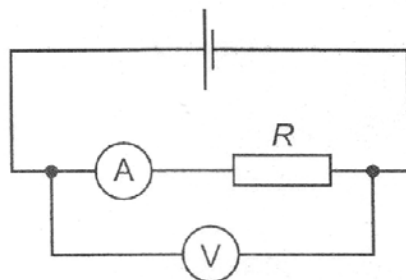
- 22 A battery has an e.m.f. of 15 V and an internal resistance of $2.0\ \Omega$.
It supplies current to a $4.0\ \Omega$ resistor.



What is the reading on the high resistance voltmeter?

- A** 5.0 V **B** 7.5 V **C** 10 V **D** 15 V

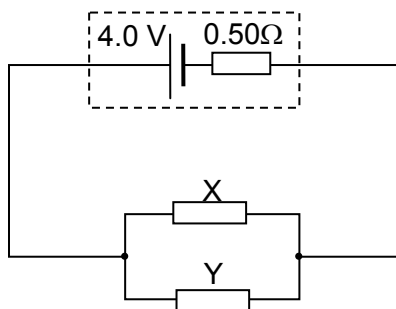
- 23 A student determines the resistance R of a resistor using the following circuit.



The resistance of the ammeter is about $\frac{R}{100}$, and the resistance of the voltmeter is about $100R$. The student calculates R by dividing the voltmeter reading by the ammeter reading.

Which statement about the calculated value of R is correct?

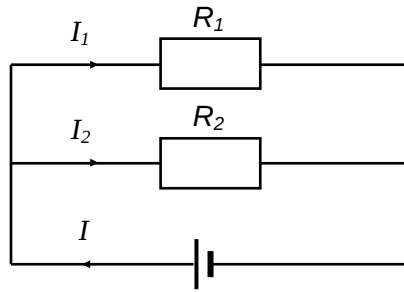
- A It is about 2 % less than the true value.
 - B It is about 1 % less than the true value.
 - C It is about 1 % more than the true value.
 - D It is about 2 % more than the true value.
- 24 The diagram shows two identical $3.0\ \Omega$ resistors, X and Y, connected in parallel across a battery of e.m.f $4.0\ \text{V}$ and internal resistance $0.50\ \Omega$.



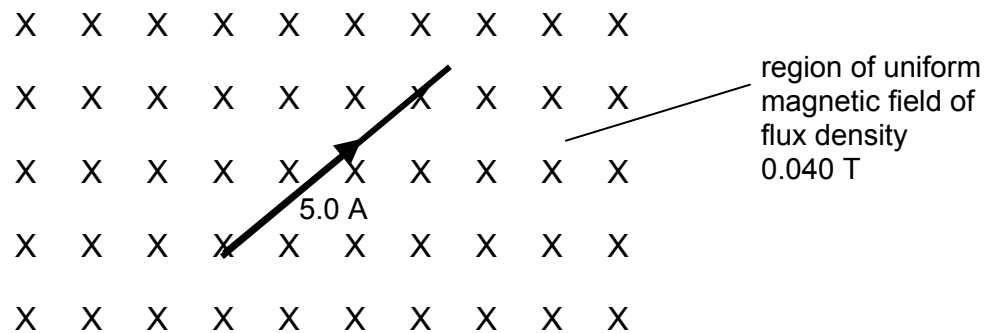
What is the current flowing through resistor Y?

- A $0.50\ \text{A}$
- B $1.0\ \text{A}$
- C $2.0\ \text{A}$
- D $4.0\ \text{A}$

- 25 In the figure below, resistance of R_1 is smaller than resistance of R_2 . Which set of relationships is correct for the currents?



- A $I = I_1 + I_2$ and $I_1 = I_2$
- B $I = I_1 + I_2$ and $I_1 > I_2$
- C $I = I_1 + I_2$ and $I_1 < I_2$
- D $I = I_1 = I_2$
- 26 A wire of length 3.0 cm is placed at right angles to a magnetic field of flux density 0.040 T. The wire carries a current of 5.0 A.



What is the magnitude of the force which the field exerts on the wire?

- A less than 0.0060 N
- B 0.0060 N
- C greater than 0.0060 N but less than 0.60 N
- D 0.60 N

- 27 An electron is moving along the axis of a solenoid carrying a current.

Which of the following is a correct statement about the electromagnetic force acting on the electron?

- A The force acts radially inwards
- B The force acts radially outwards
- C The force acts in the direction of motion
- D No force acts

- 28 An ultra-violet source of radiation causes the emission of electrons from a zinc plate. What would be the effect of a less intense source of the same wavelength on the maximum energy per electron, and on the number of electrons emitted per second?

	maximum energy per electron	number of electrons emitted per second
A	less	the same
B	the same	less
C	the same	more
D	more	less

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

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

- 30 The de Broglie wavelength of a rifle bullet of mass 0.02 kg which is moving at a speed of 300 m s⁻¹ is

- A 1.1×10^{-34} m B 1.8×10^{-35} m C 9.9×10^{33} m D 1.4×10^{35} m

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