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 **22 Sep 2011**

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 A cylindrical vessel is completely filled with liquid of mass (20 ± 1) g. The vessel has internal diameter (2.5 ± 0.1) cm and length (5.0 ± 0.1) cm. Using these values, the density of the liquid is calculated to be 814.89 kg m^{-3}. The calculated value of density should be quoted as

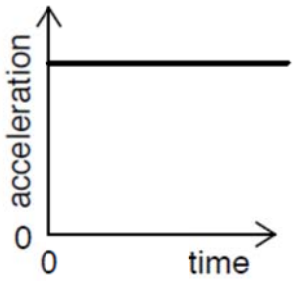
A (814.89 ± 0.15) kg m^{-3}
B (815 ± 1) kg m^{-3}
C (810 ± 90) kg m^{-3}
D (800 ± 100) kg m^{-3}

2 What is a reasonable estimate of the gravitational potential energy of a man standing on the fifth storey of a typical flat?

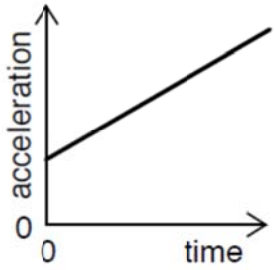
A 1.0 J
B 100 J
C 10 kJ
D 1.0 MJ

3 Which graph represents the motion of a car that is travelling along a straight road with a uniformly increasing speed?

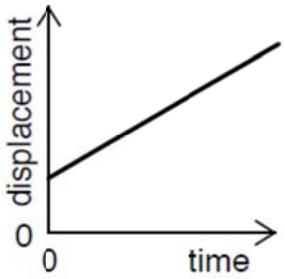
A



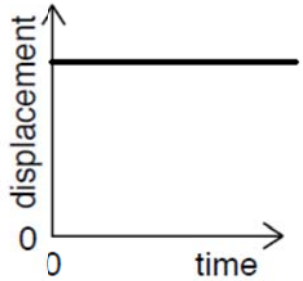
B



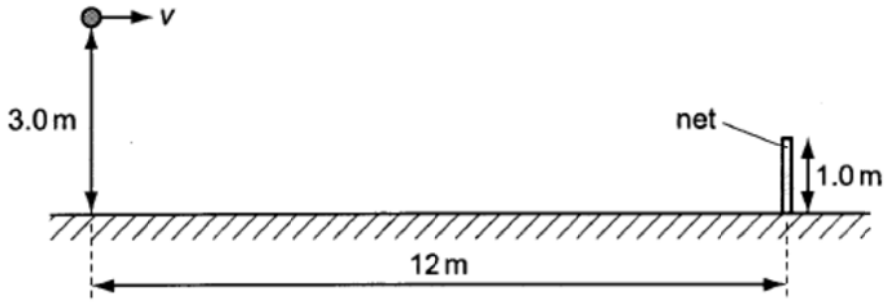
C



D



4 In a tennis match, a ball is hit horizontally with a speed v, as shown in the diagram.

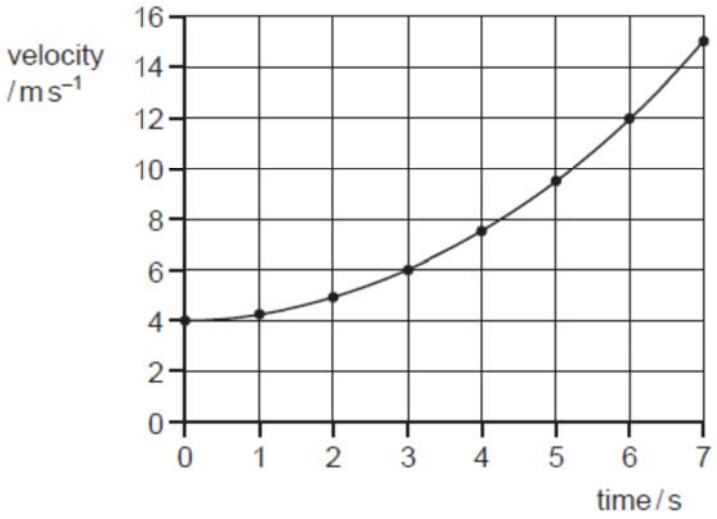


The bottom of the ball is initially 3.0 m above the ground and a horizontal distance of 12 m from the net.

The ball just clears the net, which is 1.0 m high.
What is the value of v? (neglect the effects of air resistance)

A 16 m s^{-1}
B 19 m s^{-1}
C 30 m s^{-1}
D 38 m s^{-1}

5 The diagram shows a velocity-time graph for a vehicle.



The vehicle, moving at 4.0 m s^{-1}, begins to accelerate at time = 0.
What is the vehicle's acceleration at time = 3.0 s?

A 0.67 m s^{-2}
B 1.0 m s^{-2}
C 1.6 m s^{-2}
D 2.0 m s^{-2}

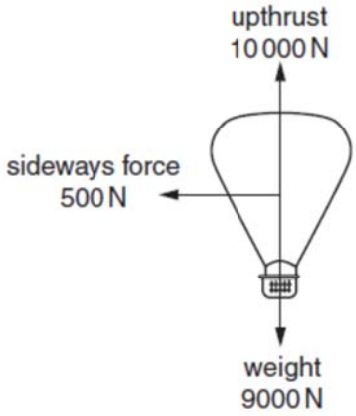
6 Two similar spheres, each of mass m and travelling with speed v, are moving towards each other.

The spheres have a head-on elastic collision.

Which statement is correct?

A The spheres stick together on impact.
B The total kinetic energy after impact is mv^2.
C The total kinetic energy before impact is zero.
D The total momentum before impact is $2mv$.

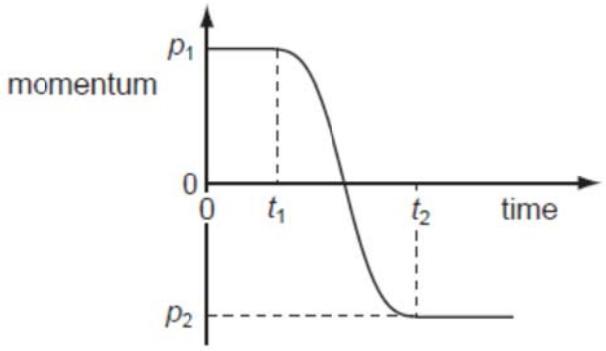
7 A balloon is acted upon by three forces, weight, upthrust and sideways force due to the wind, as shown in the diagram.



What is the resultant force on the balloon?

A 500 N
B 1000 N
C 1100 N
D 1500 N

8 The graph shows the variation with time of the momentum of a ball as it is kicked in a straight line.



Initially, the momentum is p_1 at time t_1. At time t_2 the momentum is p_2.

What is the magnitude of the average force acting on the ball between times t_1 and t_2?

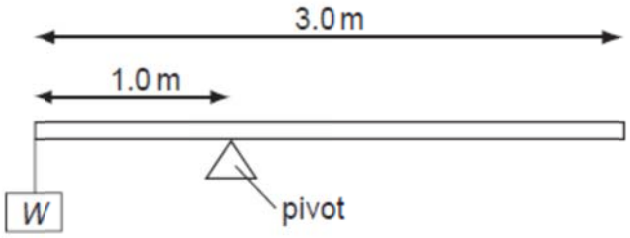
A $\dfrac{p_1 - p_2}{t_2}$

B $\dfrac{p_1 - p_2}{t_2 - t_1}$

C $\dfrac{p_1 + p_2}{t_2}$

D $\dfrac{p_1 + p_2}{t_2 - t_1}$

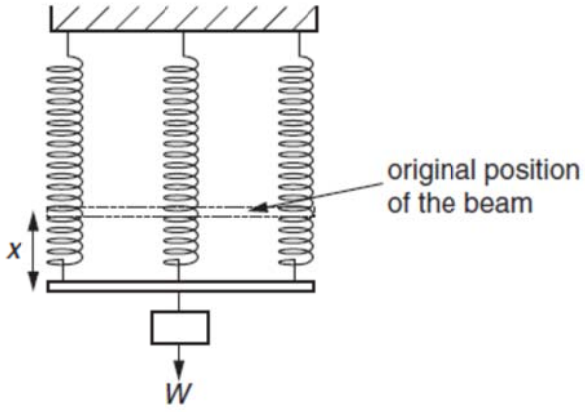
9 A uniform beam of weight 50 N is 3.0 m long and is supported on a pivot situated 1.0 m from one end. When a load of weight *W* is hung from that end, the beam is in equilibrium, as shown in the diagram.



What is the value of *W*?

A 25 N
B 50 N
C 75 N
D 100 N

10 A beam, the weight of which may be neglected, is supported by three identical springs. When a weight *W* is hung from the middle of the beam, the extension of each spring is *x*.

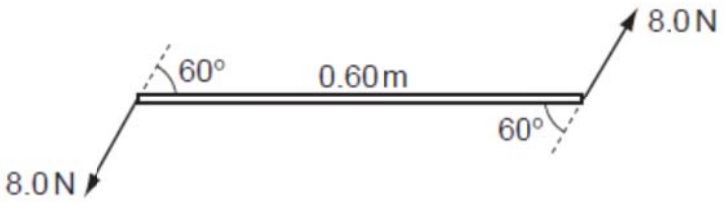


The middle spring and the weight are removed.

What is the extension when a weight of 2*W* is hung from the middle of the beam?

A 3 *x* / 2
B 4 *x* / 3
C 2 *x*
D 3 *x*

11 Two 8.0 N forces act at each end of a beam of length 0.60 m. The forces are parallel and act in opposite directions. The angle between the forces and the beam is 60°.



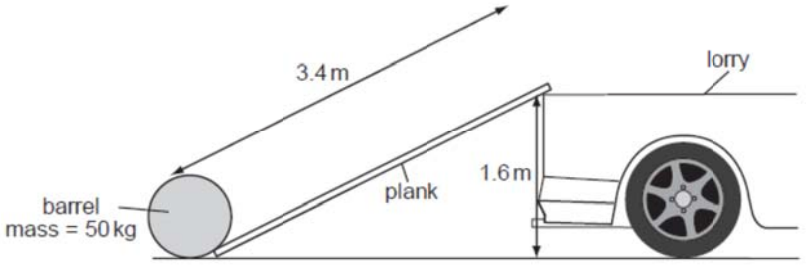
What is the torque of the couple exerted on the beam?

A 2.4 N m
B 4.2 N m
C 4.8 N m
D 9.6 N m

12 Which of the following expressions **defines** power?

A force x distance moved in the direction of the force
B force x velocity
C work done ÷ time taken
D work done x time taken

13 A barrel of mass 50 kg is loaded onto the back of a lorry 1.6 m high by pushing it up a plank 3.4 m long.



What is the minimum work done?

A 80 J
B 170 J
C 780 J
D 1700 J

14 The phase difference between two points separated by a distance of 3.0 cm in a wave of wavelength 5.0 cm is

A 0.6 rad
B 1.7 rad
C 1.9 rad
D 3.8 rad

15 Which of the following summarises the change in wave characteristics on going from infra-red to X-rays in the electromagnetic spectrum?

	frequency	**wavelength (in a vacuum)**	**speed (in a vacuum)**
A	decreases	increases	decreases
B	increases	increases	increases
C	decreases	increases	remains constant
D	increases	decreases	remains constant

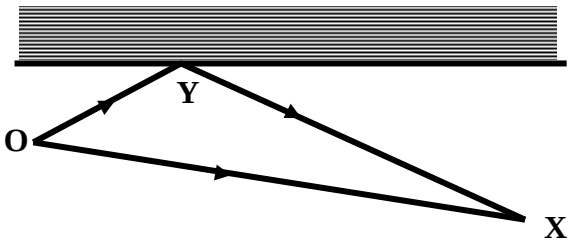
16 Transverse sinusoidal waves of wavelength λ are progressing along a horizontal rope. P and Q are points on the rope $\frac{5\lambda}{4}$ apart and the waves are travelling from Q to P. Which one of the following correctly describes Q at an instant when P is displaced downwards but moving upwards?

	displacement of Q	**movement of Q**
A	upwards	downwards
B	upwards	upwards
C	downwards	upwards
D	downwards	downwards

17 X is a tube which is closed at one end and Y is a tube that is open at both ends. Both have the same effective length. If the fundamental frequencies of X and Y are f_X and f_Y respectively, the ratio of f_X: f_Y is

A 1:1
B 1:2
C 2:1
D 2:3

18 A microwave source at point O produces waves of wavelength 28 mm. A metal reflector is placed as shown.



An interference pattern is produced. Constructive interference occurs at point X. The distance OX is 400 mm. Assume that there is no phase change when the wave is reflected.

The total path length OYX could be

A 414 mm
B 421 mm
C 442 mm
D 456 mm

19 Which of the following statements is true about the characteristics of a stationary wave?

A Separation between a node and the adjacent antinode is half a wavelength.
B Amplitude of vibration varies from a minimum at the node to a maximum at the antinode.
C Particles at the nodal positions have maximum kinetic energy.
D Particles at the antinodes have minimum potential energy.

20 The current in a component is reduced uniformly from 100 mA to 20 mA over a period of 8.0 s.

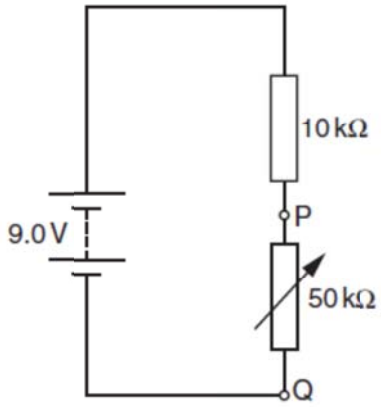
What is the charge that flows during this time?

A 160 mC
B 320 mC
C 480 mC
D 640 mC

21 What is a correct statement of Ohm's law?

A The potential difference across a component equals the current providing the resistance and other physical conditions stay constant.
B The potential difference across a component equals the current multiplied by the resistance.
C The potential difference across a component is proportional to its resistance.
D The potential difference across a component is proportional to the current in it providing physical conditions stay constant.

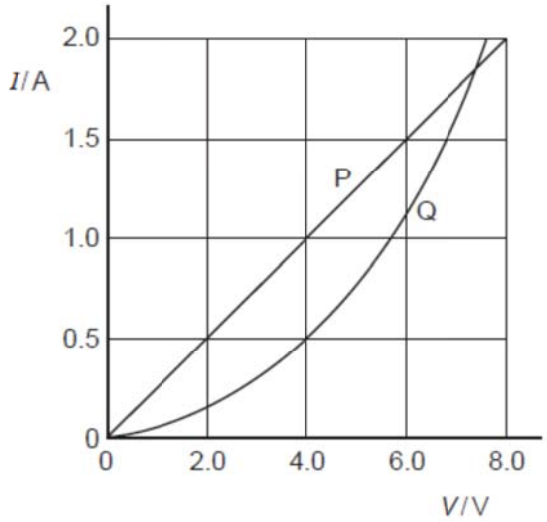
22 The diagram shows a potential divider connected to a 9.0 V supply of negligible internal resistance.



What range of voltages can be obtained between P and Q?

A zero to 1.5 V
B zero to 7.5 V
C 1.5 V to 7.5 V
D 1.5 V to 9.0 V

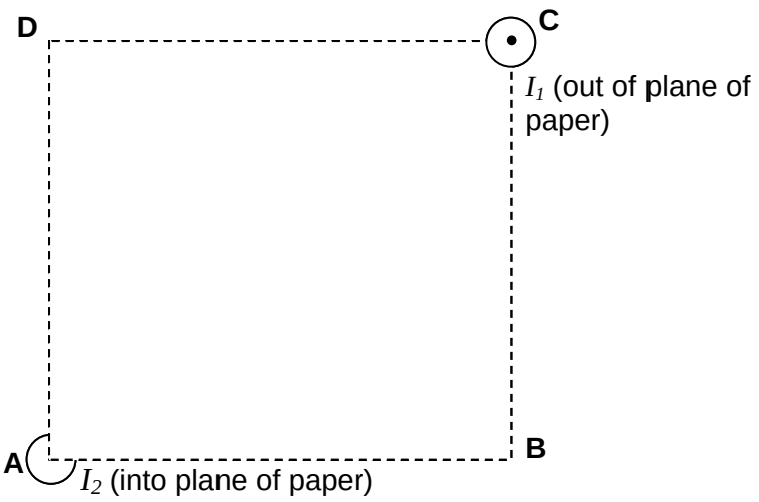
23 The I-V characteristics of two electrical components P and Q are shown below.



P and Q are connected in parallel and the reading on the voltmeter across P is 4.0 V. What is the effective resistance of P and Q?

A 0.083 Ω
B 0.38 Ω
C 2.7 Ω
D 12 Ω

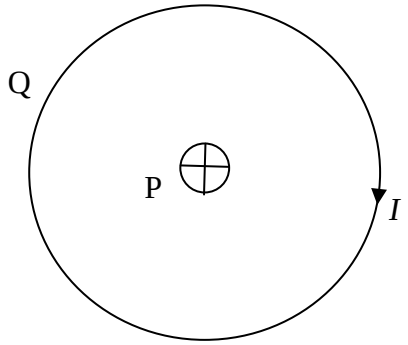
24



The figure shows two infinitely long wires carrying currents I_1 and I_2 which flow out of plane of the paper and into the plane of the paper respectively. The two currents contribute to the magnetic field at the centre of the square. What is the direction of the resultant magnetic field at the centre of the square?

A The direction is from O to A
B The direction is from O to B
C The direction is from O to C
D The direction is from O to D

25 The figure shows a circular coil of wire Q carrying a clockwise current I. P is a long, straight wire carrying a current perpendicularly into the plane of the paper through the centre of the coil.



Because of the current in P each part of the wire Q experiences

A a force towards P.
B a force away from P.
C a force perpendicular to the plane of the paper.
D no force in any direction.

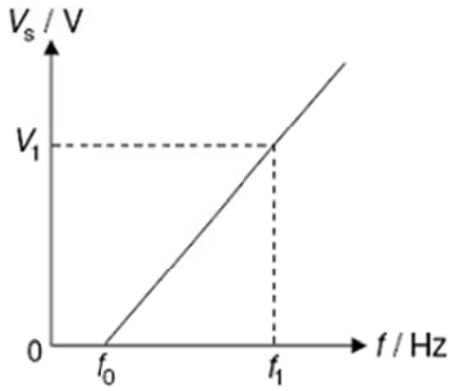
26 Two long parallel conductors carrying the same current in the same direction are placed near to each other. The magnetic field due to a current carrying conductor at a point is proportional to the current and inversely proportional to the distance between the point and the conductor. If the distance between them is halved and the current in both is doubled, the force between them will increase by a factor of

A 8
B 4
C 2
D ½

27 A student shone a beam of monochromatic light of wavelength 580 nm that is totally reflected at normal incidence by a plane mirror. The light exerts a force of 2.50×10^{-20} N on the mirror, what is the number of photons hitting the mirror per second?

A 5.5×10^{6}
B 1.1×10^{7}
C 2.2×10^{7}
D 2.8×10^{7}

28 In a photoelectric experiment, a stopping potential V_s must be applied between the irradiated surface and the collector to prevent any electrons from reaching the collector. The stopping potential is plotted for various frequencies of the incident radiation and the graph of which is shown below.



Deduce an expression for the Planck constant from the graph.

A eV_1
B $eV_1(f_1 - f_0)$
C $eV_1 \div (f_1 - f_0)$
D 0

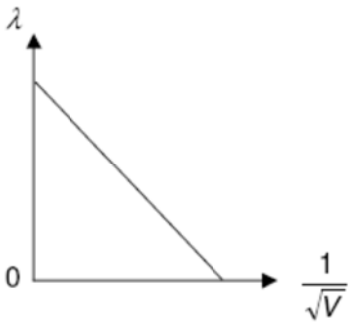
29 In a photoelectric effect experiment, ultraviolet light of wavelength 150 nm shines on a clean metal surface. The stopping potential was determined to be 1.9 V.

What is the work function of the metal used?

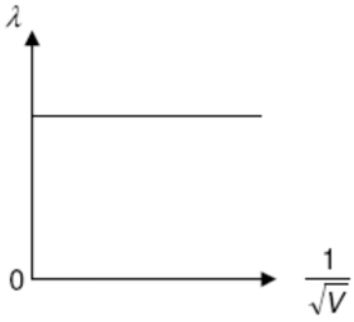
A 1.9 eV
B 6.4 eV
C 7.1 ev
D 8.3 eV

30 An electron that is accelerated from rest through an electric potential difference of V has a de Broglie wavelength of λ. Which of the following graphs correctly represents the relationship between λ and V?

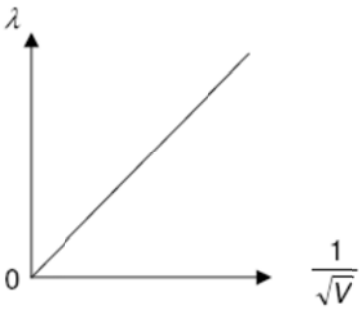
A



B



C



D