NANYANG JUNIOR COLLEGE
JC 2 Preliminary Examination
Higher 1

PHYSICS 8866/01

Paper 1 Multiple Choice **23 September 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, class and tutor's name 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 you 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	=	3.00×10^{8} m s^{-1}
elementary charge,	e	=	1.60×10^{-19} C
the Planck constant,	h	=	6.63×10^{-34} J s
unified atomic mass constant	u	=	1.66×10^{-27} kg
rest mass of electron	m_e	=	9.11×10^{-31} kg
rest mass of proton	m_p	=	1.67×10^{-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	=	ρgh
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$

1 When a constant potential difference, V (in volts) is applied, the electrical current, I (in amperes) through a strip of semiconductor varies with its temperature according to $I = \frac{V}{pT^3}$, where T is the absolute temperature (in Kelvins) and *p* is a constant.

What is the possible unit of *p*?

A J s C^{-2} K^{-3}

B J s^{-1} K^{-3}

C J s K^{-3}

D J s^{-1} C^{-2} K^3

2 The period, *T* of oscillation of an object suspended freely on a spring is given by:

$T = 2\pi\sqrt{\frac{m}{k}}$, where *m* is the mass of object in kg and *k* is the spring constant in N m^{-1}.

A student takes measurements of the period in order to calculate the value of *k*. Given that the student concluded the value of period *T* as (1.21 $\pm$ 0.03) s and the mass of the suspended object, *m* is (10.0 $\pm$ 0.1) kg, what is the correct way to express the calculated value of *k* in N m^{-1}? Take π = 3.142.

A 269.7 $\pm$ 16.1

B 270 $\pm$ 16

C 270 $\pm$ 20

D 300 $\pm$ 20

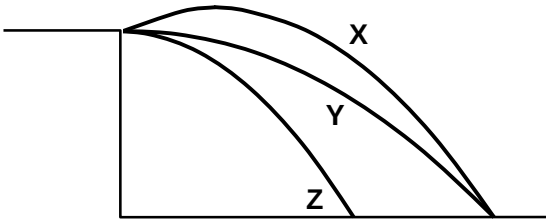
3 Four students measured and calculated the electronic charge *e*. The table shows the results obtained. Which student, **A**, **B**, **C** or **D**, obtained a set of results that could be described as most accurate but least precise?

Student	***Electronic Charge, e / 10^{-19} C***				
A	1.59	1.60	1.58	1.57	1.57
B	1.63	1.64	1.64	1.63	1.65
C	1.62	1.59	1.59	1.61	1.60
D	1.57	1.63	1.64	1.58	1.59

4 What is a realistic estimate of the magnitude of the momentum of an Olympic sprinter?

A 300 N s **B** 800 N s **C** 3000 N s **D** 8000 N s

5 The diagram below shows the paths of three balls projected from the edge of a cliff. X was projected at an angle of 20^{o} above the horizontal while Y and Z are projected horizontally.



Which of the following statements is definitely incorrect?

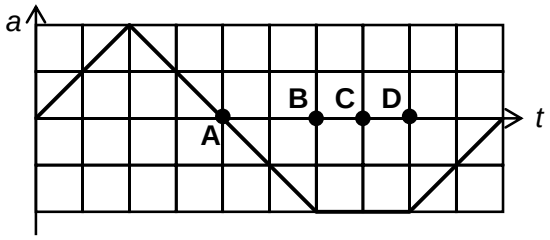
A X is projected with a lower speed than Y.

B X is projected with a lower speed than Z.

C Y and Z reach the ground at the same time.

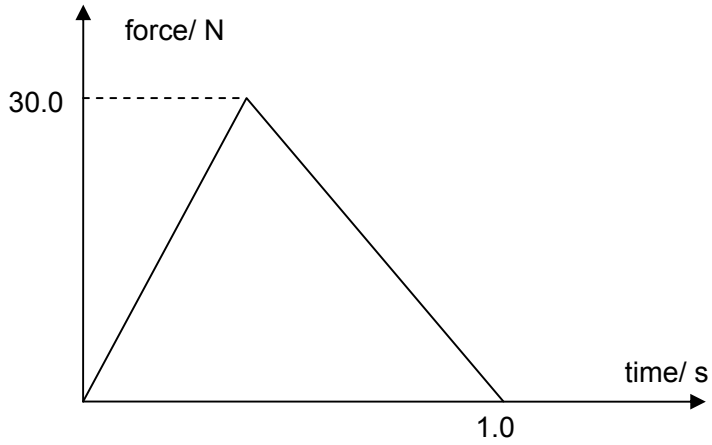
D X and Y reach the ground at the same time.

6 The diagram below shows how the acceleration of a body, *a*, which was initially at rest, varies with time, *t*.



At which time is the body the furthest from its initial position?

7 An object of mass 10.0 kg is initially moving at a velocity of 2.0 m s^{-1} on a frictionless horizontal surface. A force is then applied to the object in the same direction as its motion as shown in the graph.



What is the velocity of the object after 1.0 s?

A 3.5 m s^{-1}
B 5.0 m s^{-1}
C 35 m s^{-1}
D 50 m s^{-1}

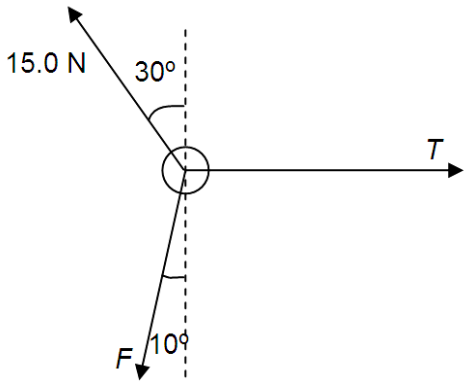
8 An object of mass *m* is hanging by a string from the ceiling of a lift. The lift is moving down with a constant deceleration. The tension in the string is

A less than *mg* (but non-zero).
B exactly *mg*.
C greater than *mg*.
D zero.

9 An object of mass *M* is moving with a velocity *v* before making a head-on collision with a stationary object of mass 3*M*. Given that the collision is elastic, the velocity of the object of mass 3*M* after the collision is

A $\frac{v}{4}$ **B** $\frac{v}{3}$ **C** $\frac{v}{2}$ **D** $\frac{3v}{4}$

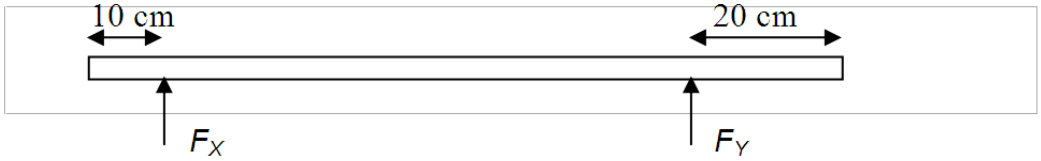
10 A light object is on a horizontal frictionless surface. It is held in equilibrium by three strings with different tensions, as shown in the diagram below. The diagram is not drawn to scale.



What is the value of the tension, T ?

A 5.2 N
B 9.8 N
C 10.7 N
D 26 N

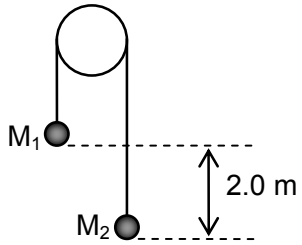
11 A uniform plank of length 100 cm is supported by two forces, F_X and F_Y at 10 cm from one end and 20 cm from the other respectively as shown.



What is the ratio of $\frac{F_Y}{F_X}$?

A $\frac{1}{2}$ **B** $\frac{3}{4}$ **C** $\frac{4}{3}$ **D** $\frac{2}{1}$

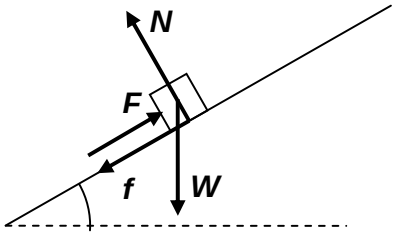
12 The diagram shows two masses M_1 and M_2 attached by a light string hanging over a smooth pulley. Initially 2.0 m apart in height, the masses are released. When they are at the same height, their speed is 2.0 m s^{-1}.



What is the ratio of M_1 / M_2 ?

A 0.50 **B** 0.67 **C** 1.50 **D** 2.00

13 The diagram below shows the forces acting on a block as it moves up a slope.



N **:** Normal reaction
W **:** Weight
F **:** Applied force
f **:** Friction

Which of the following statements is definitely correct?

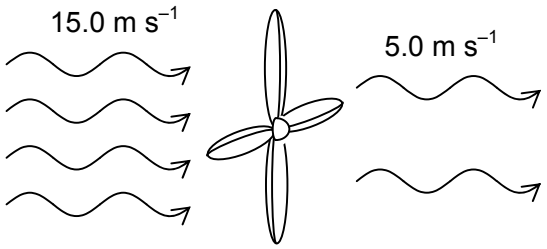
A Work done by *F* on the block is equal to the negative of work done by *f*.

B Work done by **W** on the block is equal to the gain in gravitational potential energy of the block.

C Work done by *N* is negative.

D The net work done by the four forces is equal to the gain in kinetic energy of the block.

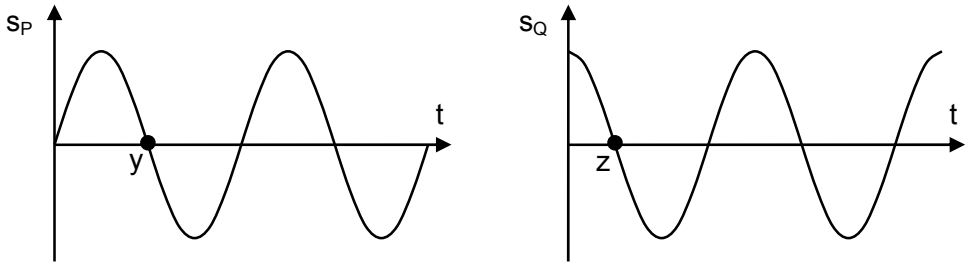
14 The function of a wind turbine is to convert the kinetic energy of wind to electrical energy. When winds of speed 15.0 m s^{-1} hit the turbine, they leave the turbine at a speed of 5.0 m s^{-1}. 1000 kg of air hits the turbine every second.



If efficiency of the turbine is 25%, what is the electrical power generated by the turbine?

A 13 kW
B 25 kW
C 100 kW
D 200 kW

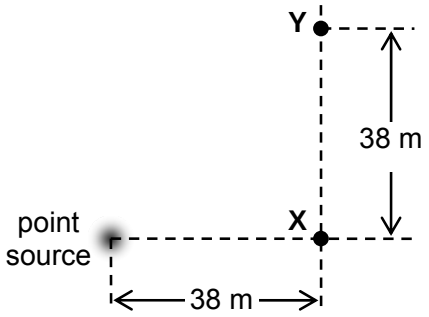
15 The diagram below shows the displacement-time graphs of two particles P and Q separated by a fixed distance of *x* along the path of a wave.



Which of the following correctly states the wavelength and speed of the wave?

	wavelength	speed
A	*4x*	*4x / y*
B	*4x*	*x / z*
C	*2y*	*y / 2z*
D	*4z*	*2z / y*

16 Waves of wavelength 1.0 m from a point source are observed from two points X and Y, as shown below.



If the amplitude of the wave observed at X is *a*, which of the following correctly states the amplitude of the wave observed at Y and phase difference between the waves at X and Y?

	Amplitude	Phase difference
A	$\frac{a}{\sqrt{2}}$	$\frac{\pi}{2}$
B	$\frac{a}{2}$	$\frac{\pi}{4}$
C	$2\ a$	$\frac{3\pi}{2}$
D	$\sqrt{2}\ a$	$\frac{3\pi}{4}$

17 Which of the following statements correctly describes the difference between a stationary wave and a progressive wave?

A A progressive wave would undergo plane polarisation while a stationary wave will not.

B The particles in a stationary wave are stationary while that of a progressive wave are vibrating.

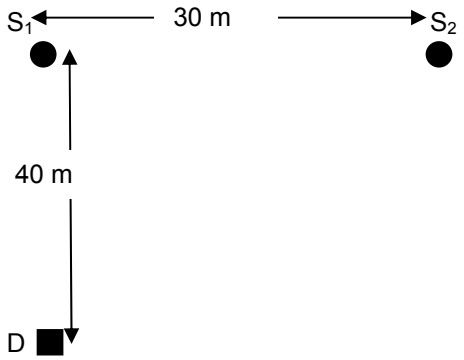
C The particles in a progressive wave are oscillating while those in a stationary wave are vibrating about their fixed positions.

D The particles in a stationary wave have different amplitudes while those in a progressive wave have the same amplitude.

18 In a Young's double-slit experiment, the distance between the slits is 2.0×10^{-3} m and the distance from the slits to the screen is 1.5 m. If the wavelength of the light used is 5.0×10^{-7} m, the distance in mm from the central bright fringe to the third order bright fringe is

A 1.13 **B** 0.75 **C** 0.50 **D** 0.25

19 Two radio transmitters S_1 and S_2 are 30 m apart. Both transmitters operate on a wavelength of 2.0 m and radiate signals of equal amplitude.



The detector D is placed at a distance of 40 m from S_1. The lines S_1S_2 and S_1D are perpendicular to each other. The detector records a minimum of intensity.

As the wavelength of the transmitters is gradually varied to a value λ_1, the detector D detects three complete cycles of change in intensity.

What is the value of λ_1?

A 0.63 m **B** 1.25 m **C** 2.50 m **D** 6.00 m

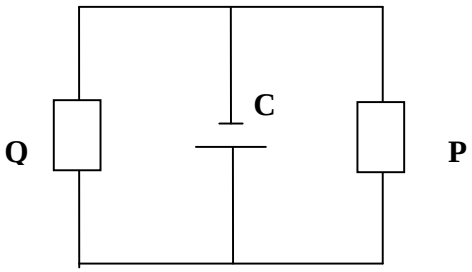
20 It is observed that when a potential difference of 2.0 V is applied across a filament lamp, there is a current of 0.30 A through it. When a potential difference of 20 V is applied across the same filament lamp, after some time, the current through the filament lamp is most likely to be

A 0.30 A
B 3.0 A
C slightly greater than 3.0 A
D slightly less than 3.0 A

21 Wire P has a resistance of R. Another wire, Q, is made of the same material as P, but has twice the length and half the diameter of wire P. The resistance of wire Q is

A $R/8$ **B** $2R$ **C** $4R$ **D** $8R$

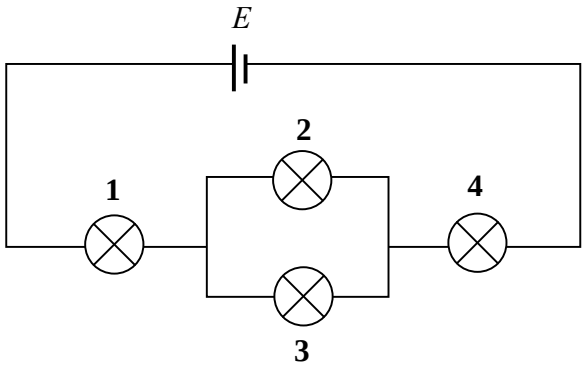
22 In the circuit shown, the cell C is ideal and has an e.m.f. of 24 V. Each of the resistors P and Q has a resistance of 10 Ω.



What is the change in power dissipated by P when the cell C is replaced with a cell with an e.m.f. of 24 V and an internal resistance of 1.0 Ω?

A 1.3 W **B** 18 W **C** 19 W **D** 41 W

23 Four identical bulbs labeled **1** to **4** are connected with a cell E of negligible resistance in the circuit shown below.



Which of the followings will result in the greatest increase in the brightness of bulb **1**?

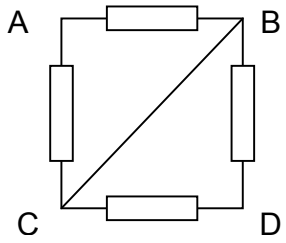
A Replace the cell E with another cell of 1.2 E

B Remove bulb **2**

C Connect another identical bulb in parallel with bulb **2**

D Connect another identical bulb in parallel with bulb **4**

24 The diagram shows a circuit consisting of four identical resistors each of resistance 2 Ω. A multimeter is used to measure the resistance across different terminals.



Which of the following statements is *false?*

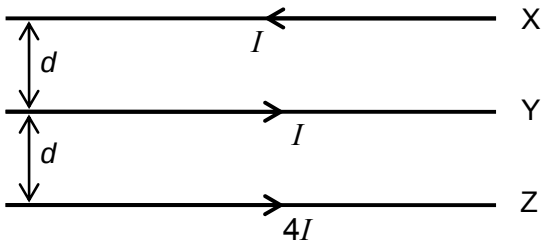
A The resistance measured between A and D is 2 Ω.

B The resistance measured between A and D will be smaller if another identical resistor is connected in parallel across BD.

C The resistance measured between A and D is 1 Ω if another identical resistor is connected across AD.

D The resistance measured between A and D is 3 Ω if a zero resistance wire is connected across AC.

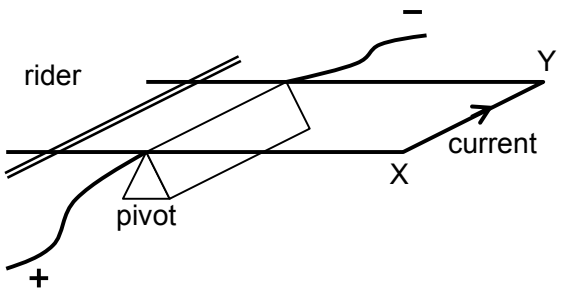
25 Wires X and Y each carries a current of I and exerts a force of *F* on each other when placed at a distance of *d* apart. The magnetic flux density of a current-carrying wire is inversely proportional to the perpendicular distance from it.



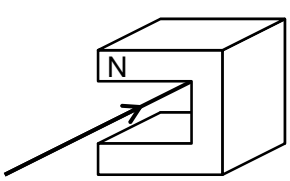
When a third wire Z carrying a current of 4 I is placed as shown above, what is the net force on X and Y?

	X	Y
A	*F*	*3F*
B	*2F*	*4F*
C	*3F*	*5F*
D	*4F*	*6F*

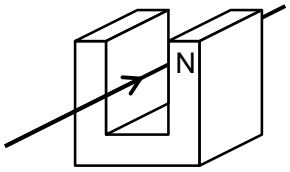
26 The diagram below shows a current balance used to determine the strength of a magnet.



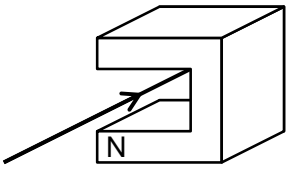
Which of the following shows the correct placement of the magnet relative to XY?



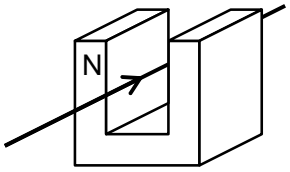
A



C

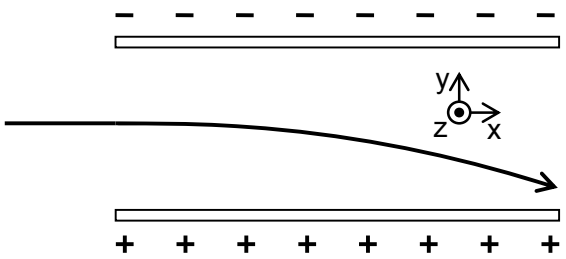


B



D

27 A light charged particle passes between two electrically charged plates and experiences deflection as shown below.



What is the direction of the magnetic field that can be applied in the same region to negate the effect of the charged plates and allow the particle to pass between the plates undeflected?

A + z **B** – z **C** + y **D** – x

28 Light of frequency *f* falls on a metal surface of work function energy ϕ and ejects electrons of maximum kinetic energy *K* by the photoelectric effect. If the frequency and the intensity of this light is doubled, what will be the maximum kinetic energy of the emitted electrons?

A $\frac{K}{2} + \phi$ **B** $2K$ **C** $2K + \phi$ **D** $4K$

29 Which of the following provides evidence for the wave nature of particles?

A Diffraction of light
B Photoelectric effect
C Stationary wave of air molecules
D Electron diffraction

30 When an atom absorbs radiation of wavelength λ_1, it makes a transition from its ground state of energy E_1 to an excited state of energy E_3. Then it makes a second transition to a state of lower energy E_2, emitting radiation of wavelength λ_2.

What is the wavelength of the radiation emitted by the atom when it makes a third transition from E_2 to E_1?

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

END OF PAPER