A Methodist Institution
(Founded 1886)

Anglo-Chinese Junior College

Physics Promotional Examination
Higher 2

CANDIDATE NAME		CLASS	
CENTRE NUMBER		INDEX NUMBER	

PHYSICS **9745/01**

Paper 1 Multiple Choice 6 October 2008
40 minutes

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 and Index number in the answer sheet provided.

There are **20** questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and circle 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 Question Paper.

Data

speed of light in free space,	c	=	3.00×10^{8} m s^{-1}
permeability of free space,	μ_o	=	$4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space,	ε_o	=	8.85×10^{-12} F m^{-1} $(1/(36\pi)) \times 10^{-9}$ F m^{-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
molar gas constant,	R	=	8.31 J K^{-1} mol^{-1}
the Avogadro constant,	N_A	=	6.02×10^{23} mol^{-1}
the Boltzmann constant,	k	=	1.38×10^{-23} J K^{-1}
gravitational constant,	G	=	6.67×10^{-11} N m^2 kg^{-2}
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	=	$\rho g h$
gravitational potential,	ϕ	=	$-\frac{Gm}{r}$
displacement of particle in s.h.m.,	x	=	$x_o \sin \omega t$
velocity of particle in s.h.m.,	v	=	$v_o \cos \omega t$
		=	$\pm \omega \sqrt{x_o^2 - x^2}$
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$
electric potential,	V	=	$\frac{Q}{4\pi\varepsilon_o r}$
alternating current/voltage,	x	=	$x_o \sin \omega t$
transmission coefficient,	T	$\propto$	$\exp(-2kd)$
	where k	=	$\sqrt{\frac{8\pi^2 m(U-E)}{h^2}}$
radioactive decay,	x	=	$x_o \exp(-\lambda t)$
decay constant,	λ	=	$\frac{0.693}{t_{1/2}}$

1 A laboratory is specially designed to simulate an environment with an acceleration of free fall g of 12.75 m s^{-2}.
Four students in the laboratory each made a series of measurements of the acceleration of free fall *g*. The table shows the results obtained.

Comparing the 4 series of measurements, which student obtained a set of results that could be described as precise but not accurate?

Student	*Results*, *g* / m s^{-2}			
A	12.75	10.99	12.79	12.78
B	10.99	11.00	11.05	10.93
C	12.29	11.97	11.69	11.39
D	12.75	13.16	12.86	11.62

2 The time taken for a free-falling body to reach the earth's surface from a tower is measured as (3.0 ± 0.1) s. The height of the tower is best represented by

A (44.145 ± 1.5) m
B (44.1 ± 1.5) m
C (44.1 ± 2.9) m
D (44 ± 3) m

3 A boy throws a stone with a velocity of 7.0 m s^{-1} vertically up to a man standing at a height of 2.0 m above him. The velocity of the stone at the instant when it was caught by the man is

A 3.1 m s^{-1} **B** 6.2 m s^{-1} **C** 9.0 m s^{-1} **D** 9.4 m s^{-1}

4 A plane flying horizontally at a speed of 50.0 m s^{-1} at a height of 160 m drops a package. Two seconds later, it drops a second package. How far apart will the two packages land on the ground?

A 100 m **B** 162 m **C** 177 m **D** 283 m

5 An object is projected upwards at an angle θ from the earth's surface. The object reaches maximum height before falling to the earth's surface. If air resistance is not negligible, which one of the following statements is true of the object's motion in air?

A The object's acceleration is constant along its entire motion
B The object's acceleration is minimum at the instant it reaches maximum height.
C The object's acceleration is maximum at the instant it was projected.
D The object experiences a maximum acceleration equal to the acceleration of free fall.

6 A solid polymer sphere of density 620 kg m^{-3} is released inside a non-viscous liquid of density 1110 kg m^{-3} at a depth of 2.80 m.
Immediately after it is released, the acceleration of the sphere is

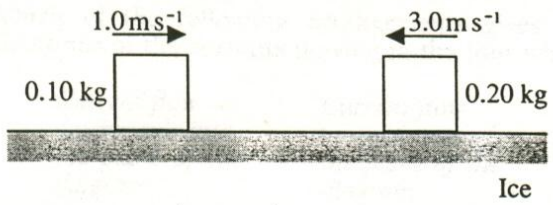
A 7.75 m s^{-2} upward
B 7.75 m s^{-2} downward
C 4.33 m s^{-2} upward
D 4.33 m s^{-2} downward

7 Car X collides with car Y. The driver of car Y claims that car X hit his car harder than his car hit car X. Which physical law(s) could be useful in the defence of the driver of car X?

1 Law of conservation of energy
2 Newton's first law of motion
3 Newton's third law of motion

A Laws stated in 1, 2 and 3 are all useful for the defence of the driver of car X
B Only laws stated in 1and 2 are useful for the defence of the driver of car X
C Only laws stated in 2 and 3 are useful for the defence of the driver of car X
D Only law stated in 3 is useful for the defence of the driver of car X

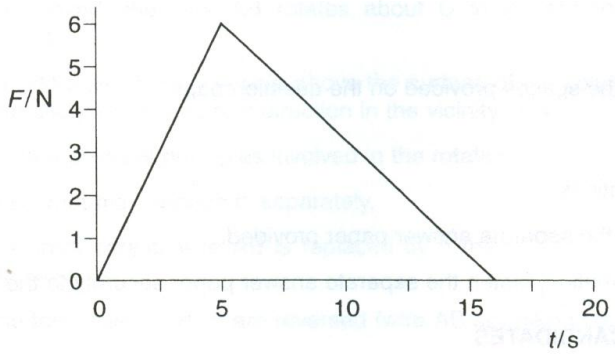
8 The diagram shows two pucks on the surface of an ice rink just prior to their head-on collision.



Immediately after the collision the puck of mass 0.10 kg has a velocity of 2.0 m s^{-1} to the left. If the time of impact is 0.02 s. What is the average force exerted on the 0.20 kg puck during collision?

A 15 N to the left
B 15 N to the right
C 30 N to the left
D 30 N to the right

9 A trolley of mass 10 kg, initially at rest, is acted on by a varying force *F* over a time *t* of 16 s as shown in figure below.



What is the average force acting on the trolley for the above duration?

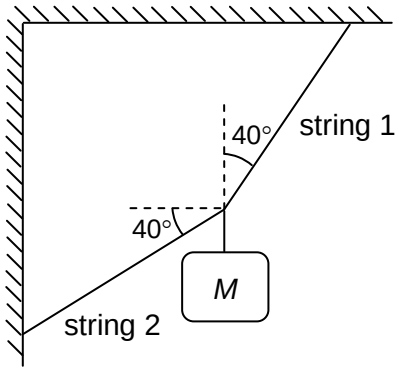
A 4.0 N **B** 3.5 N **C** 3.0 N **D** 2.5 N

10 Two identical spheres having the same mass travel with the same speed v and collide head-on elastically, on a smooth horizontal surface as shown in the figure.

Which of the following statements is correct?

A The sum of the momenta before impact is 2 mv
B The sum of the momenta after the impact is 2 mv
C The sum of their kinetic energies after impact is zero
D The sum of their kinetic energies after impact is mv^2

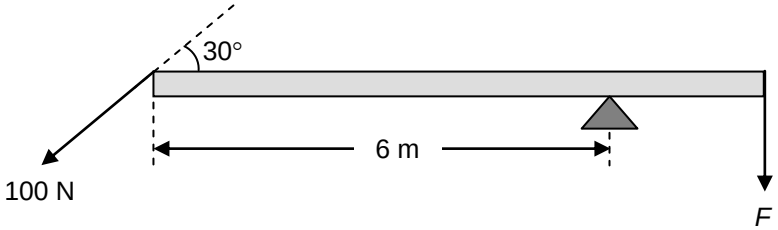
11 In the figure below, M is a wooden block of mass 1.1 kg that is hung using two strings.



The tension in string 1 when M is stationary is

A 87.5 N **B** 54.1 N **C** 47.6 N **D** 39.9 N

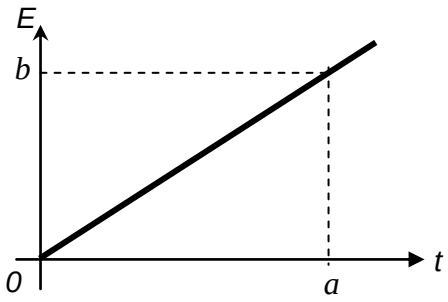
12 An 8 m long uniform rod of mass 5 kg is pivoted as shown in the figure.



The value of F so that the rod is in equilibrium is

A 309 N **B** 199 N **C** 150 N **D** 101 N

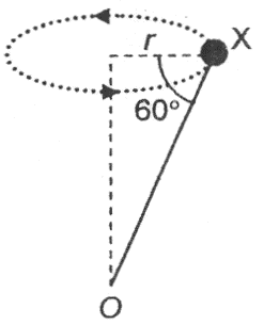
13 A toy car, driven by the power from a motor, moves with a constant velocity *v* along a straight line. The figure below represents the variation of effective energy *E* supplied by the motor to the toy car with time *t*.



If the constant driving force generated by the motor is *F*, what is the value of *v*?

A $\frac{a}{Fb}$ **B** $\frac{b}{Fa}$ **C** $\frac{2F}{ab}$ **D** $\frac{ab}{2F}$

14 A model helicopter X of mass *m* has a light inextensible cord attached to it when if flies in a horizontal circle of radius *r* with its main rotor horizontal. The cord is inclined at 60° to the horizontal while being fixed to a point O and the helicopter is traveling with angular velocity ω rad s^{-1}. The acceleration due to free fall can be taken as *g*.



Which of the following is the upward force on the helicopter due to air?

A $\frac{m\omega^2 r}{\sqrt{3}}$ **B** $m\left(\frac{\omega^2 r}{\sqrt{3}} + g\right)$

C $m\sqrt{3}\omega^2 r$ **D** $m\left(\sqrt{3}\omega^2 r + g\right)$

15 A piece of rock far out in space is at rest relative to the Earth. Under the influence of the Earth's gravitational attraction, it begins to fall towards the Earth along a straight radial line. With what speed will the rock hit the Earth?
(You may assume radius of the Earth = 6.4×10^6 m)

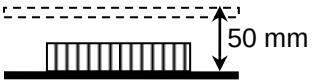
A 4.4×10^4 m s^{-1} **B** 7.9×10^4 m s^{-1}
C 1.1×10^4 m s^{-1} **D** 1.5×10^4 m s^{-1}

16 For points outside a uniform sphere of mass *M*, the gravitational field is the same as that of a point mass *M* at the centre of the sphere. The Earth may be taken to be a uniform sphere of radius *r* and density ρ.

How is the gravitational field strength *g* at its surface related to these quantities and the gravitational constant *G*?

A $g = \frac{G\rho}{r^2}$ **B** $g = \frac{3G}{4\pi r\rho}$
C $g = \frac{4\pi r\rho G}{3}$ **D** $g = \frac{4\pi r^2\rho G}{3}$

17 A coin of mass 10 grams rests on a platform that is vibrating vertically. The distance between the top-most position and the bottom-most position of the platform is 50 mm.



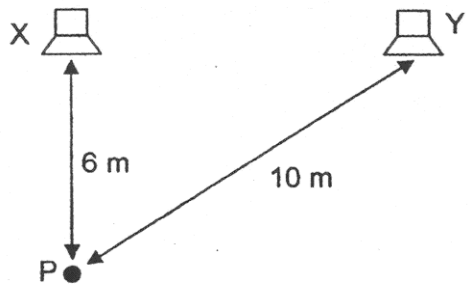
What is the maximum frequency of the vibration such that the coin does not leave contact with the platform?

A 4.4 Hz **B** 3.2 Hz **C** 2.2 Hz **D** 1.6 Hz

18 Which effect provides experimental evidence that light is a transverse, rather than a longitudinal wave motion?

A Light can be diffracted.
B Two coherent light waves can be made to interfere.
C The intensity of light from a point source falls off inversely as the square of the distance from the source.
D Light can be polarized.

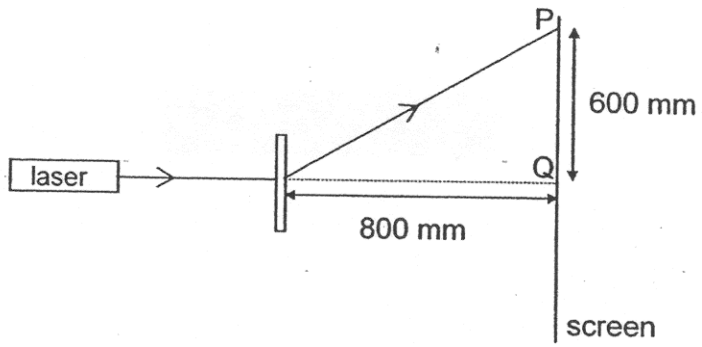
19 Two loud speakers, X and Y are π radians out of phase with each other and emit sound waves of wavelength 8.0 m and amplitude A. The waves from X and Y arrive at point P without attenuation as shown in the diagram below.



If XP is 6 m and YP is 10 m, what is the amplitude of the resultant wave at P, in terms of A?

A 0 **B** A **C** 2A **D** 3A

20 Monochromatic light of wavelength λ falls normally on a diffraction grating as shown in the figure below. The screen is parallel to the plane of the grating.



Given that the second order maximum occurs at P and the central maximum at Q. What is the spacing between the rulings of the grating?

A $\frac{5\lambda}{6}$ **B** $\frac{4\lambda}{3}$

C $\frac{8\lambda}{3}$ **D** $\frac{10\lambda}{3}$

End of paper