X15

Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS

PAPER 2

9188/2

JUNE 2012 SESSION

1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

FOR EXAMINER'S USE

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
For numerical answers, **all** working should be shown.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINATION'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

This question paper consists of 12 printed pages.

[Turn over

Data

speed of light in free space,	$c = 3.00 \times 10^{8}\ \mathrm{m\,s^{-1}}$
permeability of free space,	$\mu_0 = 4\pi \times 10^{-7}\ \mathrm{H\,m^{-1}}$
permittivity of free space,	$\epsilon_0 = 8.85 \times 10^{-12}\ \mathrm{F\,m^{-1}}$
elementary charge,	$e = 1.60 \times 10^{-19}\ \mathrm{C}$
the Planck constant,	$h = 6.63 \times 10^{-34}\ \mathrm{J\,s}$
unified atomic mass constant,	$u = 1.66 \times 10^{-27}\ \mathrm{kg}$
rest mass of electron,	$m_e = 9.11 \times 10^{-31}\ \mathrm{kg}$
rest mass of proton,	$m_p = 1.67 \times 10^{-27}\ \mathrm{kg}$
molar gas constant,	$R = 8.31\ \mathrm{J\,K^{-1}\,mol^{-1}}$
the Avogadro constant,	$N_A = 6.02 \times 10^{23}\ \mathrm{mol^{-1}}$
the Boltzmann constant,	$k = 1.38 \times 10^{-23}\ \mathrm{J\,K^{-1}}$
gravitational constant,	$G = 6.67 \times 10^{-11}\ \mathrm{N\,m^2\,kg^{-2}}$
acceleration of free fall,	$g = 9.81\ \mathrm{m\,s^{-2}}$

Formulae

uniformly accelerated motion, $s = ut + \frac{1}{2}at^2$, $v^2 = u^2 + 2as$

work done on/by a gas, $W = p\Delta V$

gravitational potential, $\phi = -\frac{Gm}{r}$

refractive index, $n = \frac{1}{\sin C}$

resistors in series, $R = R_1 + R_2 + \ldots$

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

electric potential, $V = \frac{Q}{4\pi\epsilon_0 r}$

capacitors in series, $1/C = 1/C_1 + 1/C_2 + \ldots$

capacitors in parallel, $C = C_1 + C_2 + \ldots$

energy of charged capacitor, $W = \frac{1}{2}QV$

alternating current/voltage, $x = x_0 \sin \omega t$

hydrostatic pressure, $p = \rho gh$

pressure of an ideal gas, $p = \frac{1}{3}\frac{Nm}{V}\langle c^2 \rangle$

radioactive decay, $x = x_0 \exp(-\lambda t)$

decay constant, $\lambda = \frac{0.693}{t_{\frac{1}{2}}}$

critical density of matter in the Universe, $\rho_0 = \frac{3H_0^2}{8\pi G}$

equation of continuity, $Av = \text{constant}$

Bernoulli equation (simplified), $p_1 + \frac{1}{2}\rho v_1^2 = p_2 + \frac{1}{2}\rho v_2^2$

Stokes' law, $F = Ar\eta v$

Reynolds' number, $R_e = \frac{\rho v r}{\eta}$

drag force in turbulent flow, $F = Br^2\rho v^2$

*Answer **all** questions.*

For Examiner's Use

1 **(a)** Define *velocity* and state its SI unit.

_____

_____

_____ [2]

(b) A volume of gas is enclosed in an insulated container by a frictionless piston. A molecule of mass, *m,* moving with speed, *u,* collides head-on with a stationary piston as in **Fig.1.1.**

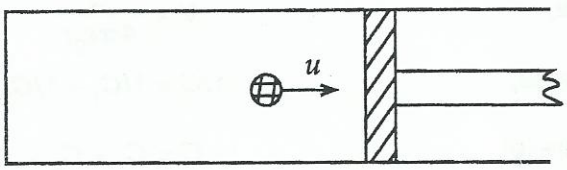

Fig.1.1

(i) Write down an expression for the molecule's momentum change.

_____

(ii) State an assumption that you made.

_____

_____ [2]

For Examiner's Use

(c) The piston is moved outwards with a velocity, v, and collides with the gas molecule in **(b)**. The molecule rebounces with a velocity, v_1, as in **Fig. 1.2.**

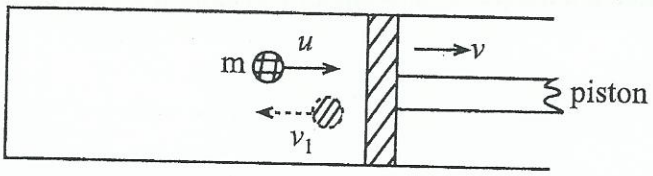

Fig.1.2

(i) Express v_1 in terms of u and v.

_____

_____

(ii) Hence deduce the effect on the gas, of this movement by the piston.

_____

_____

_____

[5]

2 **(a)** Define

(i) *force,*

_____

_____

(ii) *the newton.*

_____

_____

[5]

For Examiner's Use

(b) A body of mass 4.0 kg is pulled up a smooth plane inclined at 30° to the horizontal by a force of 40.0 N acting parallel to the plane.

(i) Sketch a diagram showing all forces acting on the mass.

(ii) Calculate

1. the resultant force, neglecting all frictional forces,

resultant force = _____

2. the acceleration of the body up the incline.

acceleration = _____

[5]

For Examiner's Use

(c) Suggest why, in practice, the value of acceleration is less than that in **b (ii)** 2.

_____

_____ [1]

3 **Fig. 3.1** shows the variation of displacement, x, with time in seconds, t, for a simple pendulum.

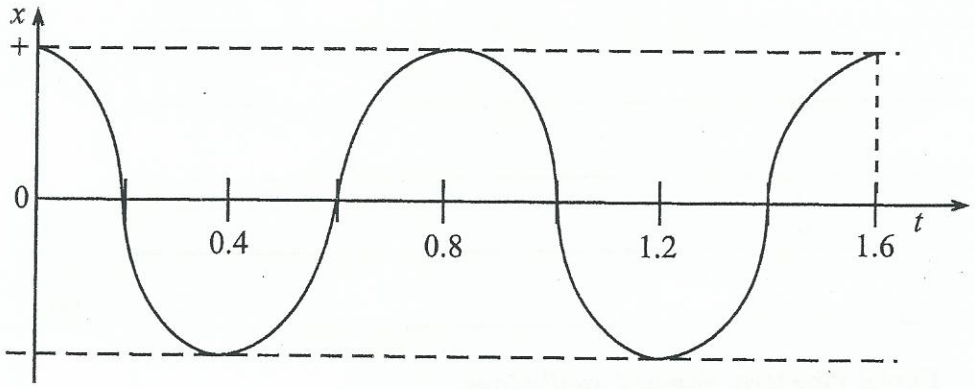

Fig. 3.1

(a) Determine

(i) the period,

period = _____

(ii) the frequency of oscillation.

frequency= _____ [2]

For Examiner's Use

(b) Sketch on **Fig. 3.1**, a graph of the variation of

(i) velocity with time and label this v,

(ii) acceleration with time and label this a. [4]

(c) Describe the energy changes that take place from the moment the pendulum is released until it completes half an oscillation.

_____

_____

_____

_____

_____

_____ [3]

(d) (i) Explain the term *damped oscillations.*

_____

_____

(ii) Give a practical example where damping is useful and state the type of damping.

example: _____

_____

type of damping: _____ [3]

4 (a) Define

(i) *stress,*

_____

_____

(ii) *strain,*

_____

_____

For Examiner's Use

(iii) *Young Modulus.*

_____

_____ [3]

(b) A mass of 12.0 kg is suspended from the ceiling by an aluminium wire of length 2.0 m and diameter 2.0 mm. If the Young Modulus of aluminium is $.7 \times 10^{10}$ Pa, calculate

(i) the tensile stress,

tensile stress = _____

(ii) the tensile strain,

tensile strain = _____

(iii) the extension,

extension = _____

(iv) the elastic energy stored in the wire.

elastic energy = _____

[7]

(c) Explain what happens to the stored energy if the elastic limit is exceeded.

For Examiner's Use

_____

_____ [1]

5 **(a)** Explain the term *non-viscous fluid.*

_____

_____

_____ [2]

(b) Air flows over the upper surface of the wings of an aeroplane at a speed of 120 ms^{-1} and past the lower surfaces of the wings at 105 ms^{-1}. The total wing area of the plane is 25 m^2 and the density of air is 1.29 kgm^{-3}.

Calculate

(i) the difference in pressure, Δp, between the upper and lower surfaces of the wings,

$\Delta p =$ _____

(ii) the 'lift' force, f, on the aeroplane.

$f =$ _____ [4]

For Examiner's Use

(c) Explain why wings are shaped like an aerofoil.

_____

_____

_____

_____ [2]

6 The work function of a metal is 2.0 eV. Monochromatic light of wavelength 5.0×10^{-7} m is used to illuminate the metal.

(a) Explain the term *work function.*

_____

_____

_____ [1]

(b) Calculate

(i) the threshold wavelength, λ,

$\lambda =$ _____

(ii) the maximum kinetic energy of photoelectrons,

maximum kinetic energy = _____

For Examiner's Use

(iii) the stopping potential.

stopping potential = _____

[6]

(c) Suggest the effects of using an intense light of wavelength 75 nm.

_____

_____

_____ [2]