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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS 9188/2

PAPER 2

JUNE 2011 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

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 EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

This question paper consists of 11 printed pages and 1 blank page.

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[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, $F = Br^2\rho v^2$

[Turn over]

*Answer **all** questions.*

For Examiner's Use

1 (a) Distinguish between a *random error* and a *systematic error*.

_____

_____

_____

_____ [2]

(b) A student wishes to use a micrometer screw gauge to measure the diameter of a wire.

(i) Suggest how the student can

1. reduce the systematic error in a reading,

_____

2. allow for a non-circular cross section of the wire,

_____

3. allow for a wire of varying diameters.

_____

(ii) The volume, V, of a cylinder of length, L, and radius, R, is given by

$$V = \pi R^2 L.$$

Calculate the radius of the cylinder and its uncertainty, given that

V = $(25.0 \pm 0.3)\ m^3$
L = (20.0 ± 0.1) cm.

radius = _____ ± _____ [6]

For Examiner's Use

2 (a) State the *universal law of gravitation*.

[2]

(b) A satellite of mass, m, is in a geostationary orbit.

(i) Define a *geostationary orbit*.

(ii) Show that the radius, r, of the orbit is given by

$$r = \sqrt[3]{\frac{gR^2}{\omega^2}}$$

where symbols have their usual meanings.

[3]

3 (a) (i) State the *Bernoulli's principle*.

(ii) Give **two** conditions necessary for Bernoulli's equation to be valid.

[3]

For Examiner's Use

(b) Oil of density 800 kgm $^{-3}$ flows along a horizontal pipe of cross-sectional area 60 cm^2 with a velocity 2.3 ms $^{-1}$. It enters a constriction of cross-sectional area 5.5 cm^2.

Calculate

(i) the velocity of oil at the constriction,

velocity = _____

(ii) the drop in pressure, Δp, which occurs when the oil enters the constriction.

Δp = _____ [4]

4 (a) State **four** assumptions of an ideal gas.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____ [4]

(b) (i) Explain the potential energy and kinetic energy that make up the internal energy of a gas.

_____

_____

_____

For Examiner's Use

(ii) Explain why the energy of an ideal gas is wholly kinetic.

_____

_____ [3]

5 (a) In an α-scattering experiment an α-particle was directed towards the centre of a gold, $\left({}^{197}_{79}\mathrm{Au}\right)$, nucleus as shown in **Fig. 5.1**. The α-particle moves with a kinetic energy of 4.8 MeV towards the nucleus.



Fig. 5.1

(i) Sketch on **Fig. 5.1** the path of the α-particle.

(ii) Determine the distance of closest approach of the α-particle to the gold nucleus.

distance of closest approach = _____ [4]

(b) State **three** uses of radioisotopes.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

For Examiner's Use

6 (i) State Kirchoff's **two** laws.

1. _____

_____

2. _____

_____

(ii) State the respective quantity conserved in each law.

1. _____

2. _____

[4]

7 (a) (i) Define the term,

1. *interference,*

_____

_____

_____

2. *diffraction.*

_____

_____

_____

(ii) State **two** conditions necessary for interference.

1. _____

_____

2. _____

_____

[4]

For Examiner's Use

(b) Light of wavelength 630 nm is incident normally on a diffraction grating with 900 lines per millimetre.

Determine

(i) the angle for the first order diffraction pattern,

angle = _____

(ii) the maximum number, N, of bright fringes which can be observed.

N = _____

[5]

8 (a) Give **one** example of

(i) an input transducer,

_____

(ii) an output transducer.

_____

[2]

(b) (i) Define *negative feedback.*

_____

_____

(ii) Give **two** advantages of negative feedback.

_____

_____ [3]

For Examiner's Use

9 (a) State **one** example of

(i) a crystalline solid,

_____

(ii) an armophous solid,

_____

(iii) a polymer.

_____ [3]

(b) Distinguish between *plastic* and *elastic* deformation.

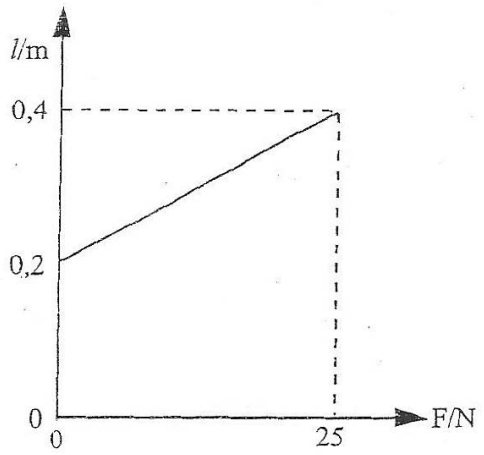
_____

_____

_____

_____ [1]

(c) **Fig. 9.1** shows the variation of length, l, with force, F, of a particular material.



(i) State with a reason if this material obeys Hooke's law.

_____

_____

(ii) Determine the maximum strain energy, E, stored in the stretched material.

For Examiner's Use

$E =$ _____ [4]