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Candidate Name	Centre Number	Candidate Number

ZIMSEC
For Performance Measurement

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.

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,	$\phi = -\dfrac{Gm}{r}$
refractive index,	$n = \dfrac{1}{\sin C}$
resistors in series,	$R = R_1 + R_2 + \ldots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \ldots$
electric potential,	$V = \dfrac{Q}{4\pi\epsilon_0 r}$
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,	$p = \frac{1}{3}\dfrac{Nm}{V}<c^2>$
radioactive decay,	$x = x_0 \exp(-\lambda t)$
decay constant,	$\lambda = \dfrac{0.693}{t_{\frac{1}{2}}}$
critical density of matter in the Universe,	$\rho_0 = \dfrac{3H_0^2}{8\pi G}$
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,	$R_e = \dfrac{\rho v r}{\eta}$
drag force in turbulent flow,	$F = Br^2\rho v^2$

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 = $(25.0 \pm 0.3)\ \text{m}^3$
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.

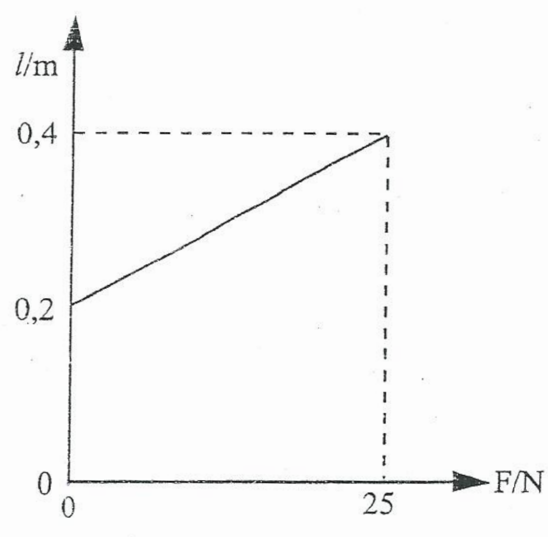
____

____

____

____ [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.

____

____

For Examiner's Use

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

$E =$ ______________

[4]