Candidate Name _____ Centre Number _____ Candidate Number _____

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS

PAPER 2

6032/2

NOVEMBER 2023 SESSION **1 hour 30 minutes**

Candidates answer on the question paper.
Additional materials:
Electronic calculator

TIME 1 hour 30 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	
TOTAL	

This question paper consists of 13 printed pages and 3 blank pages.

DATA

speed of light in free space	$c = 3.00 \times 10^{8} \text{ms}^{-1}$
permeability of free space	$\mu_o = 4\pi \times 10^{-7} \text{ Hm}^{-1}$
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12} \text{ Fm}^{-1}$ $(1/4\pi\varepsilon_0 = 8.99 \times 10^{9} \text{ mF}^{-1})$
elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
the Planck constant	$h = 6.63 \times 10^{-34} \text{ Js}$
unified atomic mass unit	$1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$
rest mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
rest mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
molar gas constant	$R = 8.31 \text{ JK}^{-1}\text{mol}^{-1}$
the Avogadro constant	$N_A = 6.02 \times 10^{23}\text{mol}^{-1}$
the Boltzmann constant	$k = 1.38 \times 10^{-23} \text{ JK}^{-1}$
gravitational constant	$G = 6.67 \times 10^{-11}\text{Nm}^2\text{kg}^{-2}$
acceleration of free fall	$g = 9.81 \text{ ms}^{-2}$

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	$\emptyset = -\,Gm/r$
hydrostatic pressure	$p = \rho gh$
pressure of an ideal gas	$p = \frac{1}{3}\frac{Nm}{V} < c^2 >$
simple harmonic motion	$a = -\omega^2 x$
velocity of particle in s.h.m.	$v = v_o \cos \omega t$
	$v = \pm\omega\sqrt{(x_o^2 - x^2)}$
Doppler effect	$f_o = \frac{f_s v}{v \pm v_s}$
Attenuation of x-rays	$I = I_o e^{-\mu x}$
electric potential	$V = \frac{Q}{4\pi\varepsilon_0 r}$
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	$W = \frac{1}{2}QV$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \ldots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \ldots$
Hall voltage	$V_H = \frac{BI}{ntq}$
alternating current/voltage	$x = x_o \sin\omega t$
radioactive decay	$x = x_o \exp(-\lambda t)$
decay constant	$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$

1 (a) State the condition for the *total linear momentum* of a system of particles to be conserved.

_____

_____ [1]

(b) A car travelling at 20 ms^{-1} collides head-on with a large rock and stops instantly. A passenger of mass 65 kg, who wears a seat belt is brought to rest in 0.5 seconds.

Calculate the

(i) constant force exerted on the passenger by the safety belt,

(ii) energy absorbed by the safety belt system. [4]

(c) (i) Explain how the headrest on car seats reduces chances of injury in case of accidents.

_____

_____

_____

_____

(ii) Describe qualitatively the motion of a body in a circular path due to a perpendicular force.

For Examiner's Use

[5]

2 (a) State the conditions which must be satisfied for a motion to be *simple harmonic*.

[2]

(b) **Fig. 2.1** shows a trolley of mass 0.5 kg attached to two springs, each of spring constant 15 N/m. It is displaced horizontally 0.3 m from it's equilibrium point.

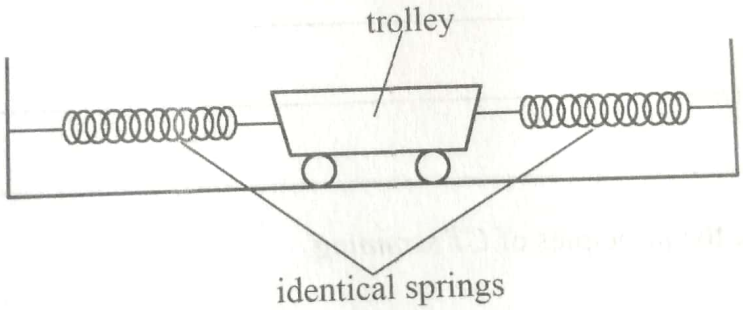

Fig. 2.1

(i) Determine the

1. angular frequency,

2. maximum speed of the trolley.

(ii) State any assumption made in **(b)(i)**.

[5]

(c) Describe the principles of *CT scanning*.

[3]

3 (a) (i) Define the *Farad*.

For Examiner Use

(ii) A 6.0 μF capacitor is charged to a p.d. of 10 V. It is then removed from the supply and it is connected in parallel with an unchanged 15 μF capacitor.

Calculate the

1. p.d across the capacitors,

2. charge on each capacitor after connection.

[6]

(b) **(i)** **Fig. 3.1** shows a logic circuit operated using two switches S_1 and S_2 to turn on a light bulb.

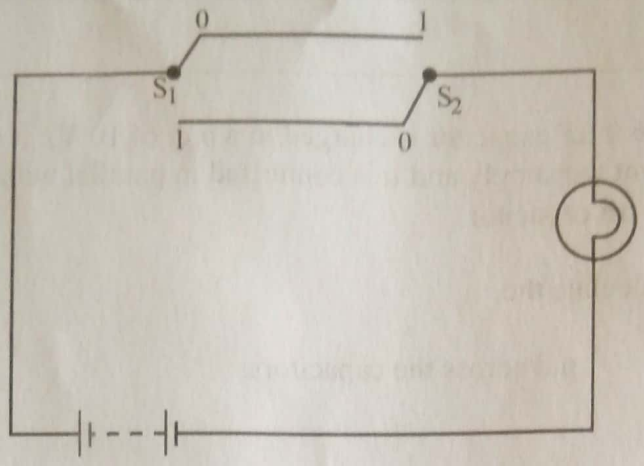

Fig. 3.1

1. Draw the truth table for the circuit.

2. Use NAND gates only, to construct a circuit that performs the same function as the circuit in **Fig. 3.1**.

[4]

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

Exam
1

(ii) Explain how the Bernoulli's principle is based on the principle of *conservation of energy*.

[3]

(b) (i) Explain using the kinetic model of matter, the difference between expansion of liquids and of solids.

(ii) Describe the use of heat that is supplied during boiling.

[4]

(c) Suggest why a container is normally closed during cooking other than for hygienic purposes.

[3]

5 **(a)** Distinguish between *emission* and *absorption line spectra*.

[2]

(b) State and explain the observations of the alpha scattering experiment.

[3]

(c) **(i)** State the relationship between *half-life* and *decay constant*.

(ii) The half-life of a radioactive isotope is 62 years.

Calculate the fraction of a sample that would remain after 31 years.

[3]

(d) In food and beverages taken there are radioactive samples present. Suggest **two** reasons why they are less harmful to the body tissues.

[2]

6 (a) Distinguish between *Amplitude Modulation* and *Frequency Modulation*.

[2]

(b) (i) State **one** disadvantage of an analogue signal.

(ii) **Fig. 6.1** shows the variation with time of an analogue signal.

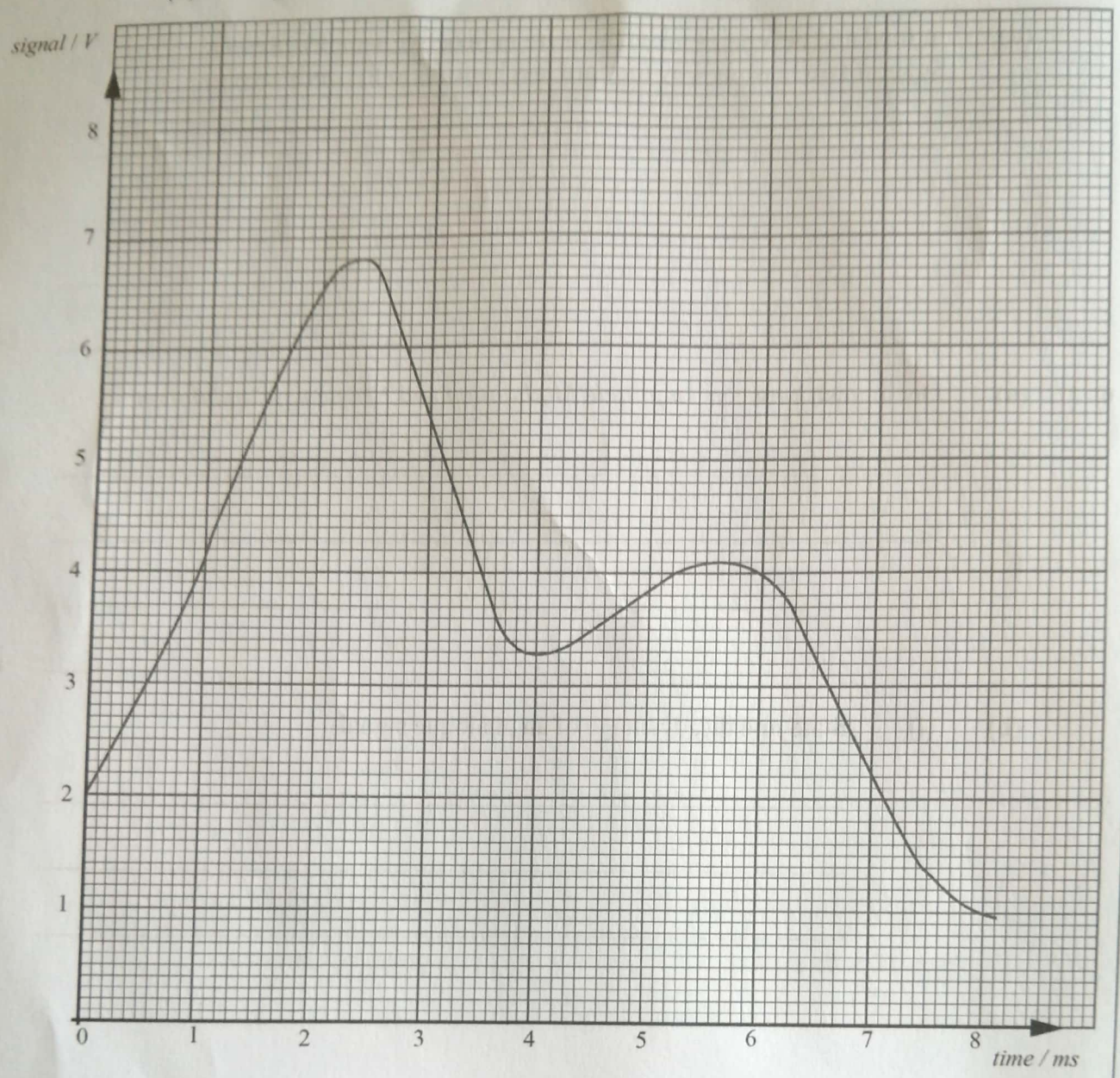

Fig. 6.1

The output is processed by a four-bit analogue to digital converter with a sampling frequency of 0.5 kHz.

1. State all the sampling voltages for the signal.

2. Express the sampled voltages in digital form.

3. Sketch a graph to show the recovered signal.

(iii) State **one** way of improving the quality of the recovered signal.

[8]

BLANK PAGE

BLANK PAGE

BLANK PAGE

5835