

**THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA  
ADVANCED CERTIFICATE OF SECONDARY EDUCATION  
EXAMINATIONS**

131/1

**PHYSICS 1**  
(For Both School and Private Candidates)

**Time: 3 Hours**

**Year: 2023**

**Instructions**

1. This paper consists of sections A and B with a total of **ten (10)** questions.
2. Answer **all** questions in section A and choose **two (2)** questions from section B.
3. Marks for each question or part thereof are indicated.
4. Mathematical tables and non-programmable calculators may be used.
5. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil.
6. Cellular phones and any other unauthorized materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. The following information may be useful:
  - (a) Acceleration due to gravity,  $g = 9.8 \text{ m/s}^2$
  - (b) The ratio of specific heat capacity,  $\gamma = 1.4$
  - (c)  $1 \text{ g of water} = 1 \text{ cm}^3$
  - (d) Latent heat of vaporization of water =  $2256 \text{ Jg}^{-1}$
  - (e) Density of water =  $10^3 \text{ kg/m}^3$
  - (f) Pie,  $\pi = 3.14$ .



## SECTION A (70 Marks)

Answer **all** questions from this section.

1. (a) (i) How is the term dimension differ from dimensional formula? **(02 marks)**
- (ii) Apply the method of dimension to deduce the value of  $x$  in the expression  $F = kA\rho V^x$ , where  $F$ ,  $V$ ,  $A$ ,  $\rho$  and  $k$  are the force acting on the body, speed, surface area, density and dimensionless constant respectively. **(04 marks)**
- (b) The pressure  $P$  can be calculated from the relation  $P = \frac{F}{\pi R^2}$ , where  $F$  is the force and  $R$  the radius. If the percentage errors of  $F$  and  $R$  are  $\pm 2$  and  $\pm 1$  respectively, determine the possible percentage error of  $P$ . **(04 marks)**
2. (a) How is the horizontal range of a projectile affected when its initial velocity is doubled for a given angle of projection,  $\theta$ ? **(04 marks)**
- (b) An aircraft travelling at 150 km/hr dropped a luggage of food to flood victims isolated on a patch of land 250 m below. Determine:
- (i) The time on which the luggage should be dropped before the aircraft is directed overhead. **(03 marks)**
- (ii) The speed of luggage as it reaches the ground. **(03 marks)**
3. (a) A car is moving with a speed of 40 m/s around unbanked curve of radius 500 m. Determine the least coefficient of friction which allows the car to negotiate the curve without sliding. **(03 marks)**
- (b) A stone of mass 1 kg attached to a string of length 1 m is whirled in a horizontal circle of radius 0.6 m at a constant speed. Calculate;
- (i) The tension in the string. **(04 marks)**
- (ii) The maximum number of revolutions per second it can make. **(03 marks)**
4. (a) (i) Give two daily life examples on which Newton's first law of motion applies. **(02 marks)**
- (ii) Sand drops vertically at the rate of 100 g/s on a horizontal conveyor belt moving at a steady velocity of 5 cm/s. Find the force required to keep the belt moving. **(03 marks)**

- (b) Figure 1 shows the system of forces being at equilibrium.

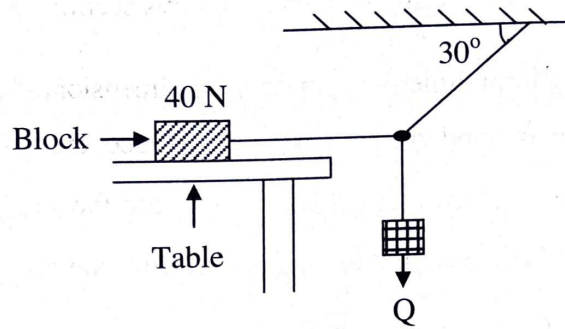


Figure 1

Determine the maximum value of the force  $Q$  if the friction force on the block cannot exceed 12 N. **(05 marks)**

5. (a) A motor car tyre has a pressure of 4 atmospheres at a room temperature of  $27^\circ\text{C}$ . If the tyre suddenly burst, calculate the temperature of the escaping air. **(03 marks)**
- (b) (i) Distinguish between triple point of water and thermometric property as used in heat. **(03 marks)**
- (ii) The resistance  $R_\theta$  of a particular resistance thermometer at a Celsius temperature  $\theta$  as measured by a constant volume gas thermometer is given as  $R_\theta = 2.50 \times 10^{-4} \theta^2 + 0.1850\theta + 40.0$ . Calculate the temperature as measured on the scale of the resistance thermometer which corresponds to a temperature of  $70^\circ\text{C}$  on the gas thermometer. **(04 marks)**
6. (a) (i) What is meant by reversible process as applied in thermodynamics? **(01 mark)**
- (ii) Distinguish isobaric process from isochoric process. **(03 marks)**
- (b) If 1 g of water is subjected at a pressure of  $1.013 \times 10^5$  Pa it becomes  $1671 \text{ cm}^3$  of steam. Calculate; **(03 marks)**
- (i) The external work done. **(03 marks)**
- (ii) The increase in internal energy of the system. **(03 marks)**
7. (a) Analyse three possible solutions to the side effects of global warming. **(03 marks)**
- (b) (i) Briefly explain four major causes of water pollution. **(04 marks)**
- (ii) What are the three disadvantages of using solar energy? **(03 marks)**

## SECTION B (30 Marks)

Answer **two (2)** questions from this section.

8. (a) (i) Identify two conservation laws embodied in Kirchhoff's rules stating its physical significance. **(02 marks)**
- (ii) Why is it safe for a bird to stand on a high voltage wire without being harmed? **(02 marks)**
- (b) Study the circuit diagram in Figure 2 and apply Kirchhoff's rules to find the values of the currents  $I_1$ ,  $I_2$  and  $I_3$ . **(04 marks)**

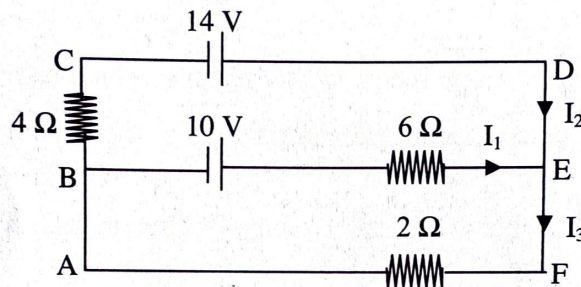


Figure 2

- (c) (i) A capacitor of  $1 \mu\text{F}$  is used in a television circuit where the frequency and the current flowing are 1000 Hz and 2 mA (r.m.s) respectively. Compute the voltage across the capacitor. **(03 marks)**
- (ii) Determine the current flowing when an a.c voltage of 20 V (r.m.s) and frequency of 50 Hz is connected to a capacitor in 8 (c) (i). **(04 marks)**
9. (a) (i) Comment on the argument that electrical conductivity of a semiconductor depends on temperature variation. **(02 marks)**
- (ii) Draw a circuit diagram showing a reverse biased diode. **(02 marks)**
- (iii) Why there is a very little current flow in the circuit drawn in (a) (ii)? **(01 mark)**
- (b) (i) Study the circuit diagram in Figure 3 then find the gain of the amplifier. **(03 marks)**

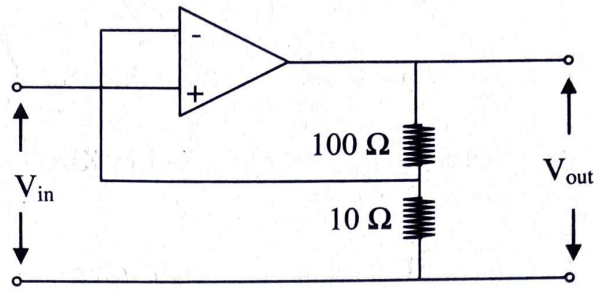


Figure 3

- (ii) Generate the truth table for the logic gates in Figure 4. (03 marks)

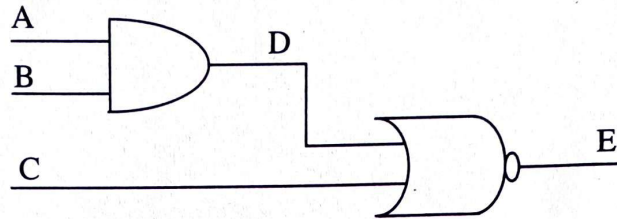


Figure 4

- (c) (i) What is meant by a voltage follower? Give one importance. (02 marks)
- (ii) Draw a diagram to show an Op-Amp as a voltage follower. (02 marks)
10. (a) (i) Sketch the circuit symbol for NPN transistor showing the direction of a convectional current. (02 marks)
- (ii) Under what condition does a semiconductor diode behave as an open switch? (02 marks)
- (b) (i) Why insulators do not conduct electricity under ordinary condition? Explain in terms of energy band theory. (03 marks)
- (ii) A common emitter amplifier has an input resistance of  $0.5 \Omega$  and output resistance of  $45 \Omega$ . If the current gain,  $\beta = 65$ ; find the voltage gain. (03 marks)
- (c) (i) What is the purpose of the barrier potential difference in a P-N Junction? (02 marks)
- (ii) Identify two advantages of a junction diode and sketch its characteristic curve which shows how it can act as a rectifier. (03 marks)