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, $g = 9.8\ m/s^2$
   (b) The ratio of specific heat capacity, $\gamma = 1.4$
   (c) 1 g of water = $1\ cm^3$
   (d) Latent heat of vaporization of water = $2256\ Jg^{-1}$
   (e) Density of water = $10^3\ kg/m^3$
   (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, ρ 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 ± 2 and ± 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, θ ? **(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.

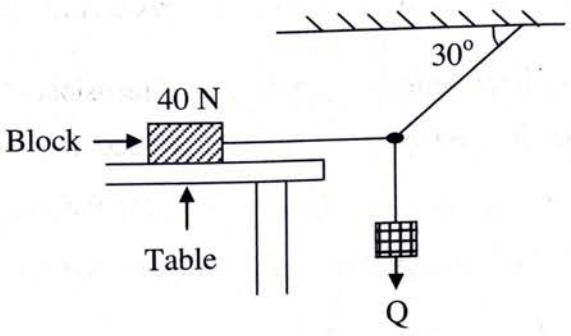


Figure 1

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 °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_θ of a particular resistance thermometer at a Celsius temperature θ as measured by a constant volume gas thermometer is given as $R_\theta = 2.50\times10^{-4}\theta^2 + 0.1850\theta + 40.0$. Calculate the temperature as measured on the scale of the resistance thermometer which corresponds to a temperature of 70 °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 1.013×10^5 Pa it becomes 1671 cm^3 of steam. Calculate;

(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)**

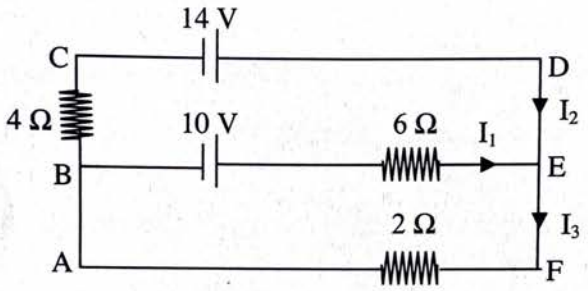


Figure 2

(c) (i) A capacitor of $1\,\mu F$ 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)**

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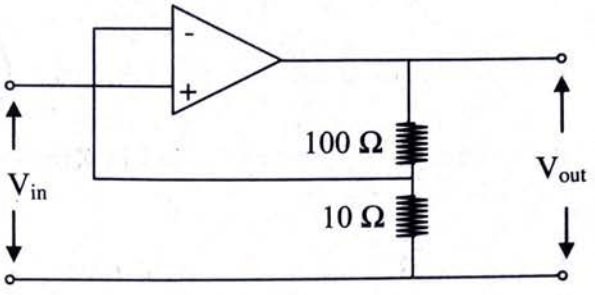


Figure 3

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

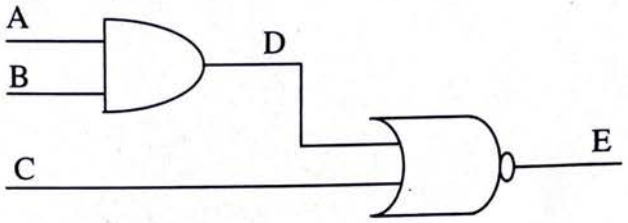


Figure 4

(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 Ω and output resistance of 45 Ω. 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)**

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