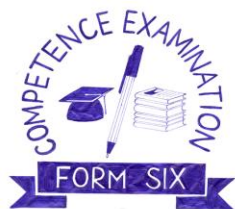


THE PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
FORM SIX COMPETENCE EXAMINATIONS (FOSCE) - 2025



CODE: 131/1

PHYSICS 1

TIME: 3 HOURS

21st FEBRUARY 2025, AM

INSTRUCTIONS:

1. This paper consists of **section A** and **B** with total of **ten (10)** questions. Answer **ALL** questions in section A and choose **two (2)** questions from section B.
2. Marks for each question are indicated in a given question.
3. Stefan's constant, $\sigma = 5.67 \times 10^{-8} \text{Wm}^{-2}\text{K}^{-4}$
4. All working must be shown clearly on how you arrived at the answer.
5. Mathematical tables and non-programmable calculators may be used
6. Cellular phones are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklets.
8. The following information may be useful:
 - (a) Acceleration due to gravity, $(g) = 9.8 \text{ m/s}^2$
 - (b) Stefan's constant $\sigma = 5.67 \times 10^{-8} \text{Wm}^{-2}\text{K}^{-4}$
 - (c) Density of water $\rho_w = 1000 \text{kg/m}^3$
 - (d) Gravitation constant $G = 6.67 \times 10^{-11} \text{Nm}^2 \text{kg}^{-2}$
 - (e) Mass of the earth $M_e = 6.0 \times 10^{24} \text{kg}$
 - (f) $\gamma = 1.4$
 - (g) Molar gas constant $R = 8.31 \text{Jmol}^{-1}\text{K}^{-1}$
 - (h) Specific heat capacity of water $C_w = 4200 \text{Jkg}^{-1}\text{K}^{-1}$
 - (i) Radius of the sun $R_s = 6.92 \times 10^5 \text{km}$
 - (j) Thermal conductivity of glass $= 1.0 \text{Wm}^{-1}\text{K}^{-1}$
 - (k) Thermal conductivity of air $= 0.02 \text{Wm}^{-1}\text{K}^{-1}$
 - (l) Radius of the earth, $R = 6400 \text{km}$
 - (m) Density of air $= 1.23 \text{kg/m}^3$

1. (a) (i) Explain the statement that, “the accuracy of measurement depends upon the least count of the measuring instrument”. **(01 mark)**
- (ii) Two form six students used two different measuring instruments A and B to measure the length of the same rod, the results obtained were recorded in table as shown below:

Experiment Number	1	2	3	4
Instrument A (cm)	3.1	3.0	3.2	3.1
Instrument B (cm)	3.12	3.11	3.10	3.11

Basing on your knowledge suggest with reasonable reason, between A and B which instrument is better in measurement of length. **(03 marks)**

- (b) (i) One of uses of dimensional equations is to check the correctness of physical relation. Explain why we can’t use it in conclusion of magnitude of value obtained by a given physical relation. **(02 marks)**

- (ii) Pressure depends on distance as $P = \frac{\alpha}{\beta} e^{-\frac{\alpha z}{K\theta}}$ where α, β are constant, z is distance, K is Boltzmann’s constant and θ is temperature. Find the dimension of β . **(04 marks)**

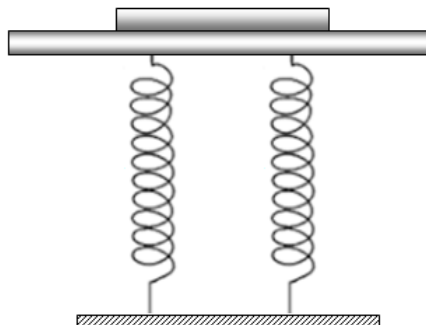
2. (a) (i) In long jump does it matter how high you jump? State two factors which determine the span of the jump. **(02 marks)**
- (ii) A bullet is fired from a gun on the top of a cliff 140 m high with a velocity of 150m/s at an elevation of 30° to the horizontal. Find the horizontal distance from the roof of a cliff to the point where the bullet land on the ground. **(04marks)**
- (b) In a crash test, a car of mass 1.2×10^3 kg collides with a wall and rebounds as illustrated below. The initial and final velocities of the car are 12 ms^{-1} to the left and 2 ms^{-1} to the right respectively. The collision lasts 0.1 s.



Calculate the:

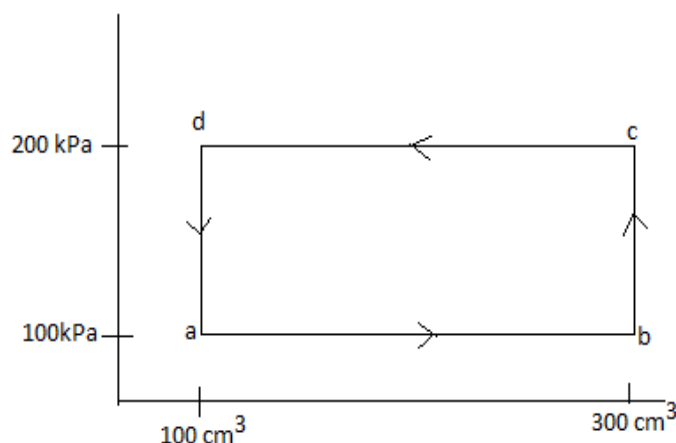
- (i) The coefficient of restitution.
- (ii) Average force exerted on the car.
- (iii) Impulse of the car during the accident. **(04 marks)**

3. (a) A tray of mass 12Kg is supported by two identical springs as shown in figure below.



When the tray is pressed down slightly and released, it executes S.H.M with a time period of 1.5s.

- (i) What is the force constant of each spring? **(02.5 marks)**
- (ii) When a block of mass M is placed on the tray, the period of S.H.M changes to 3.0s. What is the mass of the block? **(02.5 marks)**
- (b) A conical pendulum consists of 1m long, inextensible string one end attached to a fixed point and the other end carrying a bob of mass 20g. The bob is moving in horizontal circle of radius 0.3m. Calculate the speed of the bob and the tension on the string. **(05 marks)**
4. (a) (i) What is the reason for no atmosphere on the moon? **(03 marks)**
- (ii) A satellite takes 24 hours to revolve on its orbit around the earth. Find the height above the earth at which the satellite should be placed. **(03 marks)**
- (b) (i) Show that the rotational kinetic energy of a ball rolling over a horizontal plane is $\frac{2}{7}$ of its total kinetic energy. (Given the moment of inertia of the ball is $\frac{2}{5}MR^2$) **(04marks)**
5. (a) (i). If you have two spoons of the same size, one silver and one stainless steel, there is quick test to tell which is which. Hold the ends of a spoon in each hand, and then lower them both into a cup of very hot water. One spoon will feel hot first. Is that silver spoon or the stainless-steel spoon? Explain **(03 marks)**
- (ii) State the law applied when a body is cooling under forced convection. **(02 marks)**
- (b) The temperature of the body falls from 30°C to 20°C in 5 minutes. The air temperature is 13°C . Find the temperature after further 5 minutes. **(05 marks)**
6. (a) (i) Explain why Air pressure in car tires increases during driving. **(01 mark)**
- (ii) If refrigerator door is kept open, will the room become cool or hot? Explain. **(01mark)**
- (iii) A thermodynamic system is taken through the cycle abcda as shown in figure Below.

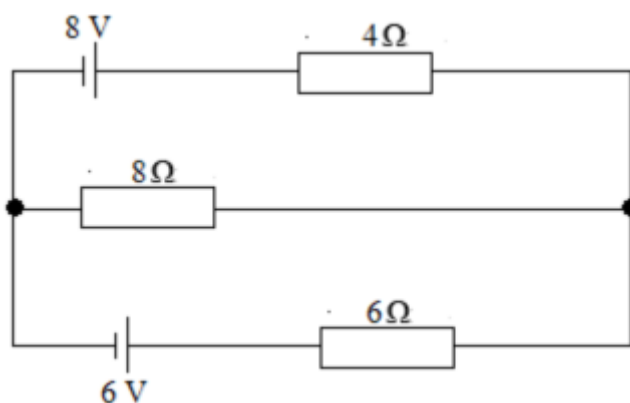


- Calculate the work done by the gas during the parts ab, bc and da. **(03marks)**
- (b) A quantity of air ($\gamma = 1.4$) at 27°C is compressed:
- Slowly and
 - Suddenly to one third of its volume. Find the change in temperature in each case **(05 marks)**
7. (a) (i) What are the factors that influence the velocity of p and s- waves? **(2.5 marks)**
- (ii) Explain clearly how p and s-waves were used to ascertain that the outer core of the earth is in liquid form. **(2.5 marks)**
- (b) (i) “Wind turbines and fan blades” they are said to work antagonistically. Explain the statement. **(2 marks)**
- (ii) Calculate power extracted by a wind turbine of blade's length 50m if the wind is blowing at a speed of 10 m/s , the density of air is 1.23 kg m^{-3} and the power coefficient is 0.3. **(03 marks)**

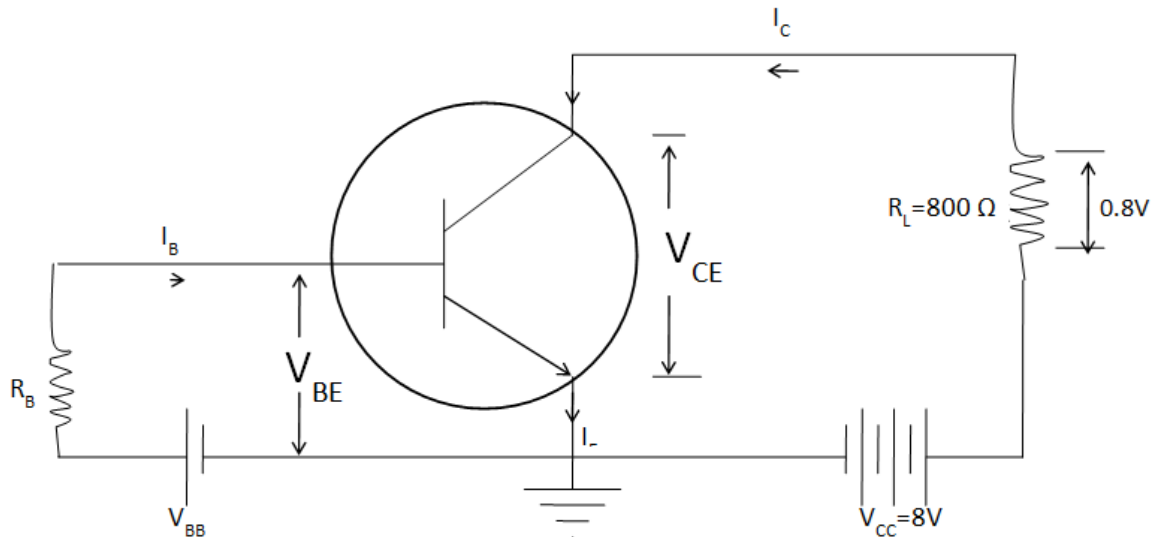
SECTION B (30 Marks)

Answer any two questions from this section

8. (a) (i) How does the drift velocity of electrons in a conductor vary with increase in temperature? **(02 marks)**
- (ii) Resistivities of copper, silver and manganin are $1.7 \times 10^{-8} \Omega\text{m}$, $1.0 \times 10^{-8} \Omega\text{m}$ and $44 \times 10^{-8} \Omega\text{m}$ respectively. Which of these is the best conductor? **(03 marks)**
- (b) (i) When resistances are connected in parallel, the total resistance decreases. Why? **(02 marks)**
- (ii) What is the current in 8Ω resistor in the figure shown below? **(03 marks)**



- (c) (i) In how many equal parts a wire having a resistance of $100\ \Omega$ be cut so that we may obtain a resistance of $1\ \Omega$ by connecting them in parallel? **(03 marks)**
- (ii) A wire is connected across a source of constant potential difference. After some time, the wire becomes hot. If cold water is poured on half of its portion, what will happen? **(02 marks)**
9. (a) (i) Identify two basic types of bipolar transistors. **(02 marks)**
- (ii) Which one among the transistors identified in a (i) above responds quickly to electrical signals? Give reason for your answer. **(02 marks)**
- (b) (i) Sketch the graph of transfer characteristics of a transistor. **(02 marks)**
- (ii) Interpret the significance of the gradient of the transfer characteristics graph. **(02 marks)**
- (c) A PNP transistor is connected in common emitter configuration in which collector supply is 8 V and the voltage drop across the load resistance of $800\ \Omega$ connected in the collector circuit is 0.8 V .
- (i) If the current amplification factor is 25, determine the collector–emitter voltage and base current. **(04 marks)**
- (ii) If the input resistance of the transistor is $200\ \Omega$, calculate the voltage gain and power gain. **(04 marks)**



10. (a) A carrier waves of frequency 10MHz and peak value 10V is amplitude modulated by 5kHz sine wave of amplitude 6V. Determine
- Modulating factor. **(01marks)**
 - Sideband frequencies. **(01marks)**
 - Amplitude of sideband components. Draw the frequency spectrum. **(03marks)**
- (b) (i) The input resistance of a silicon transistor is 665Ω . Its base current is changed by 15 micro-Ampere Which results in change in collector current by 2Ma. This transistor is used as a common emitter amplifier with load resistance of $5k\Omega$ what is the voltage gain of the amplifier? **(03marks)**
- (ii) Explain the effect of temperature on the transistor performance. **(02marks)**
- (c) In a car a real warming light comes ON when the door is not closed properly or the seat belt is not fastened or both door and seat belt are not properly secured. Construct a truth table showing the door and seat input to a logic gate system. **(05marks)**