The Times Secondary School
Dillibazar, Kathmandu
First Terminal Examination – 2080

Grade: - XII   Set A   Full Marks:-75

Stream: Science   Pass Marks:-30

Subject: - Physics   Time : 3hrs

Candidates are required to give their answers in their own words as far as practicable.
*The figures in the margin indicate the full marks.*

Attempt all questions

Group 'A'

Rewrite the best alternative to the following questions.   **(11×1 = 11)**

1. A thin disc and a thin ring, both have mass M and radius R. Both rotate about axes through their centre of mass and are perpendicular to their surfaces at the same angular velocity. Which of the following is true?
   a. The ring has higher kinetic energy
   b. The disc has higher kinetic energy
   c. The ring and the disc have the same kinetic energy
   d. Kinetic energies of both the bodies are zero since they are not in linear motion

2. The correct relationship between Moment of Inertia, Torque, and Angular acceleration is
   a. Angular acceleration = Torque x Moment of inertia
   b. Angular acceleration = Torque / Moment of inertia
   c. Moment of inertia = Angular acceleration x Torque
   d. Moment of inertia = Angular acceleration + Torque

3. The displacement vs time graphs of 2 SHMs are given below. Which parameter is the same for both of them?
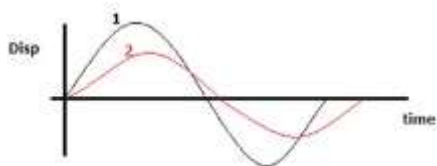
   a. Angular frequency   b. Amplitude
   c. Maximum speed   d. Phase constant

4. If we had a system on which 10 J of work is done and the internal energy change of the system is 3.5 J, in this case, the amount of heat loss/gain by the system will be?
   a. 6.5J   b. -6.5J   c. 2.85J   d. 13.5J

5. Heat is transferred to a heat engine from a furnace at a rate of 80 MW. If the rate of waste heat rejection to a nearby river is 50 MW, determine the thermal efficiency for this heat engine.
   a. 47.5 %   b. 27.5 %   c. 37.5%   d. none of the mentioned

6. A sound of source of frequency 550Hz emits wave of wavelength 65cm in air at 20°C. what is the velocity of sound in air at this temperature?
   a. 350m/s   b. 332m/s   c. 360.5m/s   d. 357.5m/s

7. The shape of the interference pattern depends on the _____
   a. Distance between the slits   b. Distance between the slits and the screen
   c. Wavelength of light   d. Shape of the slit

8. The equation → $\sum e = \sum IR$ is applicable to which law?
   a. Kirchhoff's second law   b. Kirchhoff's junction rule
   c. Kirchhoff's third law   d. Kirchhoff's current Law

9. What is the maximum torque on a rectangular coil of area 4 cm × 80 cm of 400 turns, when carrying a current of 103 A in a magnetic field of 0.2 T?
   a. 1250 Nm   b. 2560 Nm   c.3600 Nm   d.1985 Nm

10. An electron is projected in a uniform magnetic field along the direction of field, the electron will experience:
    a. a force opposite to magnetic field
    b. a force in the direction of magnetic field
    c. no force in magnetic field
    d. a force perpendicular to the magnetic field

11. Barrier potential of a P-N junction diode does not depend on
    a. doping density   b. diode design
    c. temperature   d. forward bias

Group 'B'

Answer the following questions.   **(8 × 5 = 40)**

12. In the absence of external torque, angular momentum of rotating body remains constant.
    a. Define moment of inertia and angular momentum. [2]
    b. A constant torque of 200 Nm turns a wheel about its center. The moment of inertia about the axis is 100 kgm2. Find the angular velocity gained in 4 seconds. [3]

13. a. What is simple harmonic motion? How it is different than linear motion? [2]
    b. Figure shows the mass spring system of spring constant k, e is the extension produced due to the load and y is the displacement produced in the system due
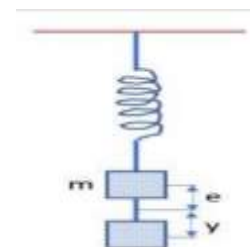

    to external force. Find the time period of the system. [2]
    c. What happens to the time period if mass is doubled? [1]

14. Adiabatic process is a thermodynamic process.
    a. Define adiabatic process. [1]
    b. Derive expression for adiabatic equation. [3]
    c. Write formula to calculate work done during adiabatic process. [1]

15. a. Define an open organ pipe. [1]
    b. How stationary waves are formed in open organ pipe? [1]
    c. Describe various modes of vibration air column in an open organ pipe.[3]

    OR

    a. Velocity of sound increases on cloudy day. Why? [1]
    b. Discuss the effect of temperature and pressure on velocity of sound in air. [2]
    c. at what temperature velocity of sound is increased by 50% to that at 27^0C [2]

16. Kirchhoff's rules are applied in complex circuits
    a. State Kirchhoff s laws. [2]
    b. using Kirchhoff's laws find current through 2Ω resistor [3]
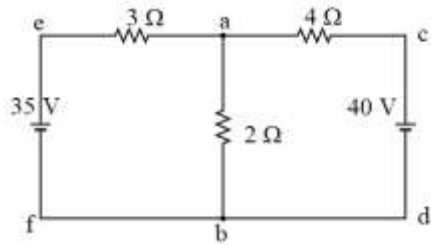
17. a. Describe quantum nature of radiation. [1]
    b. Which phenomenon justify the particle nature of light? [1]
    c. 500 nm wavelength of light falls on a photo sensitive material work function 2.9 eV. Compute the maximum energy of photoelectrons. [3]

18. When a charge particle moves in a uniform magnetic field, it experiences a force, called the Lorentz force.
    a. What is the vector representation of Lorentz force? [1]
    b. State Fleming left hand rule. [2]
    c. Calculate the force on a conductor of length 12cm having current 8A and flux density 3.75 units at an angle of 30^0 [2]

19. a. What is reverse biasing of a junction diode? [1]
    b. Draw I-V graph of junction diode in forward biasing and hence find forward resistance of junction diode using graph [2]
    c. Sketch the symbol of two inputs NOR gate and write its truth table. [2]

    OR

    a. What is quantization of charge? Why was ordinary oil not recommended in Millikan's experiment? [2]
    b. In Millikan's experiment, an oil drop of mass 4.9×10^{-14}kg is balanced by applying a potential difference of 9.8kV between the two plates which are 12.8mm apart. Calculate the number of elementary charges on the drop. (Take g=10ms^{-2}). [3]

Group C

Give long answer to the following questions. **(3 × 8 = 24)**

20.
    a. State Huyge's principle.[1]
    b. Use the principle to verify law of refraction. [3]

c. In Young's double slit experiment, the two slits are separated by 0.28mm and the screen is placed at a distance of 1.4m away from the slits. the distance between the centre fringe and the fifth dark fringe is measured to be 1.35cm calculate the wavelength of light used. Also find the fringe width if the screen is moved 0.4m towards the slits, for the same experiment set up. [4]

21. a. Write the working principle of moving coil galvanometer . [1]
    b. Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer? [2]
    c. How is a moving coil galvanometer converted into an ammeter? Explain giving the necessary circuit diagram and the required mathematical relation used [3]
    d. Name any two factors on which the current sensitivity of a galvanometer depends. [2]

    OR

    a. state and explain Biot -Savarts law [2]
    b. Use it to find out the magnetic field at a point due to a current carrying straight conductor [3]
    c. Two long parallel conductors carry respectively currents of 12A and 8A in the same direction. If the wires are 10 cm apart, find where a third parallel wire also carrying a current must be placed so that the force experienced by it will be zero [3]

22. a. An electron passes through a space without deviation. Does it mean, there is no fields? [2]
    c. Show that the motion of electrons in electric field is parabolic in nature. [3]
    d. An electron beam after being accelerated from rest through a potential difference of 5 KV in vacuum is allowed to impinge normally on a fixed surface. If the incident current is 50μ A. Determine the force exerted on the surface assuming that it brings the electrons to rest. Take mass of electron is 9.1×10^{-31} Kg. [3]

    OR

    a. What is Hall effect? [2]
    b. Deduce the expression for Hall voltage. [3]
    c. Calculate the hall voltage when the magnetic field is 8 A/m, current is 4A, width is 5 m and the concentration of carrier is 10^{20}. [3]

The End

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 **Attempt all questions**

Group 'A'
Rewrite the best alternative to the following questions.   **(11×1 = 11)**

1. If the moment of inertia of a rotating body is increased then what will be the effect on the angular velocity?
   a.   It will increase
   b.   There will be no effect
   c.   It will decrease
   d.   First increase and then decrease

2. The physical quantity in translational motion, which is analogous to moment of inertia in rotational motion is
   a.   Velocity   b.   Force   c.   Energy   d.   Mass

3. What is the relation between time periods of the two given SHMs.
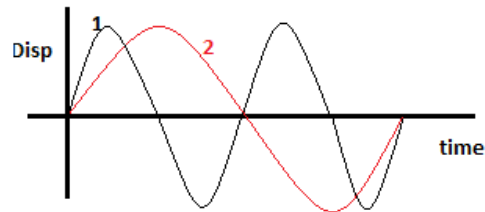
   a. $4T_1 = T_2$
   b. $T_1 = 2T_2$
   c. $2T_1 = T_2$
   d. $T_1 = 4T_2$

4. The change in internal energy of a 2 moles of a gas is -10 J. Find the work done on the gas if the process is adiabatic.
   a.   20J   b.   5J   c.   10J   d.   -10J

5. Nepal Airlines aircraft engine takes in 9000 J of heat and discards 6400 J in each cycle. The thermal efficiency of the engine is
   a.   27%   b.   28%   c.   26%   d.   30%

6. Distance between two consecutive nodes in a standing wave is
   a. λ b. $\lambda/4$ c. $\lambda/2$ d. $\lambda/3$

7. When Two waves of same amplitude add constructively, the intensity becomes ___
   a.   Double   b.   Half   c.   Four Times   d.   One-Fourth

8. Which among the following is true?
   a.   According to Kirchhoff's law, the current flowing towards a junction is equal to the voltage drop
   b.   According to Kirchhoff's law, the current flowing towards a junction is equal to the resistance across the junction
   c.   According to Kirchhoff's law, the current flowing towards a junction is equal to the current leaving the junction
   d.   According to Kirchhoff's law, the current flowing towards a junction is equal to all the currents in the circuit

9. What torque acts on a 50 turn coil of 200 cm2 area carrying a current of 20 A held with its axis at right angles to a uniform magnetic field of 0.2T?
   a.   8 Nm   b.   0.8 Nm   c.   4 Nm   d.   0.8 Nm

10. A charged particle passes through an electric field 'E' and magnetic field 'B' in mutually perpendicular directions. Find the velocity of the charged particle if it goes undeflected through both fields.
    a.   E x B   b. $\frac{E}{B}$ c. $\frac{B}{E}$ d.   E+B

11. In the reverse biasing of p-n junction,
    a. large amount of current flows
    b. potential barrier across junction increases
    c. depletion layer resistance increases
    d. no current flows

Group 'B'
Answer the following questions.   **(8 × 5 = 40)**

12. (a) Define angular momentum of a rigid body. [I]
    (b) If earth contracts to half its radius, what would be the length of the days? [2]

    (c) Define torque and write a relation between torque and moment of inertia. [2]

13. a) What is simple pendulum? [1]
    (b) Figure shows a massive body suspended by a weightless string of length /. When the mass is displaced through the displacement of x and released, it will oscillate freely.
   i) Which force is responsible for the vibration? [1]
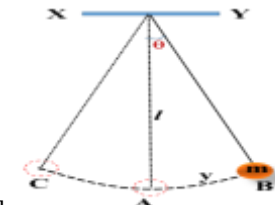
    ii) Derive its time period? [2]
    iii) If we perform this experiment inside water, what will happen to the motion? [1]

14. a) Draw a PV diagram of a petrol engine and explain its working based on the PV diagram. [3]

b) Why is Cp always greater than Cv ? Explain.[2]

15. a. Define organ pipes.[1]

b. Describe various modes of vibration of air column in a closed organ pipe.[3]

c. What is end correction of an organ pipe?[1]

OR

a. State Newton's formula for the velocity of sound in gases [1]

b. Derive Laplace's corrected formula for the velocity of sound [3]

c. Discuss the effect of density of medium on velocity of sound.[1]

16. Kirchhoff's rules are applied in complex circuits

a. State Kirchhoff s laws. [2]

b. Using Kirchhoff's laws find current through 20Ω and 40Ω resistors [3]
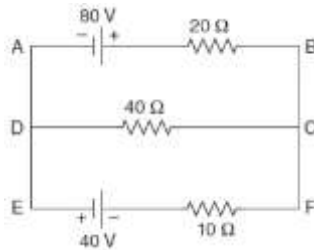
17. a. Define the terms work function and stopping potential [2]

b. Sodium has a work function of 2 eV. Calculate the maximum energy and speed of the emitted electrons when sodium is illuminated by radiation of wave length 150 nm. [3]

18. When a current carrying conductor moves in a uniform magnetic field, it experiences a force

a. Write name of the force and give its vector representation [2]

b. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid-air by a uniform horizontal magnetic field B What is the magnitude of the magnetic field? [3]

19. a. Sketch the symbol of two inputs NAND gate and write its truth table. [2]

b. Explain the working mechanism of full wave rectifier. [3]

OR

a. Write the purpose and principle of Millikan's oil drop experiment [2]

b. In Millikan oil drop experiment a charged drop of mass 1.8×10^{-14}kg is stationary between the plates. The distance between the plates is 0.9cm and potential difference is 2000 V. The number of electrons in the drop are (g =10m/s^2) [3]

Group C

Give long answer to the following questions. (3 × 8 = 24)

20. a. What are coherent sources? Write the condition of constructive interference. [2]

b. If the distance between the two slits is doubled, what will be the change in the fringe width [2]

c. In Young's double slit experiment, the two slits are separated by 0.28mm and the screen is placed at a distance of 1.4m away from the slits. the distance between the center fringe and the fifth dark fringe is measured to be 1.35cm calculate the wavelength of light used. Also find the fringe width if the screen is moved 0.4m towards the slits, for the same experiment set up. [4]

21. a. Write the working principle of moving coil galvanometer . [1]

b. Why should the spring/suspension wire in a moving coil galvanometer have low torsional constant? [2]

c. How is a moving coil galvanometer converted into a voltmeter? Explain giving the necessary circuit diagram and the required mathematical relation used [3]

d. Write two reasons why a galvanometer cannot be used as such to measure the current in a given circuit. [2]

OR

a. State and explain Ampere circuital law [2]

b. Use it to find magnetic field at the center of a long current carrying solenoid [3]

c. A circular coil has 100 turns and a mean diameter of 20 cm. It carries a current of 5 A. Find the strength of the magnetic field at a point on its axis at a distance of 15 cm from the center of the coil. [3]

22. a. Compare the specific charge of an electron and that of a proton [2]

c. describe the J.J Thomsons experiment to determine the specific charge of an electron. [3]

d. In a Thomson experiment, voltage across the plates is 50V and the distance between them is 3 cm. The magnetic field applied to make the beam undeflected is 10^4T. What is the velocity of the electron passing between the plates? [3]

OR

a. What is the Hall field? [2]

b. Deduced the relation of Hall coefficient [3]

c. Calculate the Hall voltage when the magnetic field is 6A/m, the current is 3A, the width is 4 m, and the concentration of carrier is 10^{21} [3]

The End