



The Times Secondary School
Dillibazar, Kathmandu
First Terminal Examination – 2076

Grade: XII
Stream: Science
Subject: Physics

Set A

Full Marks: 75
Pass Marks: 30
Time: 3hrs.

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

GROUP-A

1. Answer in brief, any four questions: (4×2=8)

- If electron does not suffer any deflection while passing through a region, are you sure that there is no magnetic field and electric field?
- What changes in length of solenoid occurs when a current flows through it?
- Write down an expression for the force on a current carrying conductor placed in a magnetic field and define one ampere current in terms of this force.
- What is advantage of measuring the resistance by Wheatstone bridge?
- As a light bulb ages, it gives off less light than when new. Why?
- If the length of a cylinder wire is increased by 50%, how many times does its resistance increase?

2. Answer in brief, any four questions: (4×2=8)

- What is the evidence that cathode rays are not electromagnetic radiations?
- When P-type and N-type materials are interfaced, there exists a depletion layer at the interface. Explain.
- Why a gas at very low pressure below 0.0001mm of Hg does not conduct electricity? Can a vacuum conduct electricity?
- Would you expect effects due to the photon nature of light to be generally more important at the low frequency end of the electromagnetic spectrum (radio waves) or at the high frequency end (X rays and gamma rays)? why?
- How do you find the number of electrons in Millikan's oil drop experiment to find the charge of electron?
- For the same level of doping, why is the conductivity of N -type semiconductor is greater than that of P-type semiconductor?

3. Answer in brief, any one question: (1×2=2)

- What properties of the medium are relevant for the sound transmission? Explain.
- If you are walking on the moon, can you hear cracking sound behind you? Explain.

4. Answer in brief, any one question: (1×2=2)

- What is wavefront? Distinguish between wavefront and wavelets.
- What is importance of measuring speed of light?

GROUP B

5. Attempt any three questions: (3×4=12)

- Why the voltmeter has very high resistance? How do you convert the galvanometer into voltmeter?
- What is Hall effect? Obtain an expression for the Hall emf in terms of area of cross section, width of strip, magnitude of magnetic field and the current carried by the strip.
- What is mechanism of metallic conduction? Derive the relation between current density and drift velocity of the electrons.
- Derive an expression for the torque experienced by current carrying rectangular coil placed in a magnetic field.

6. Attempt any three questions: (3×4=12)

- Show that frequency and time period of revolution of an electron in a magnetic field is independent of velocity of electron when it enters into the magnetic field.
- Write down Einstein's photoelectric equation and describe an experiment to verify it.
- Explain the use of a p-n junction diode as a rectifier. Draw the circuit diagram of a full wave rectifier using diodes and explain its working.
- Explain the experiment of finding the amount of charge in an electron in an electric field is so adjusted that the oil drop remains stationary.

7. Attempt any one questions: (1×4=4)

- Write Newton's formula for the velocity of sound in air. Explain why this formula has to be modified. Discuss the Laplace's correction?
- How is a progressive wave different from a stationary wave. Derive a progressive wave equation

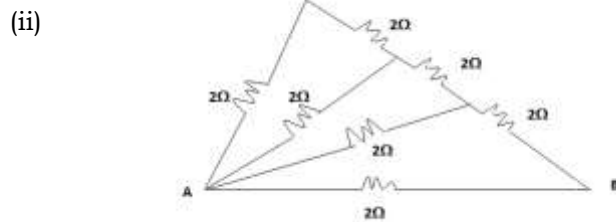
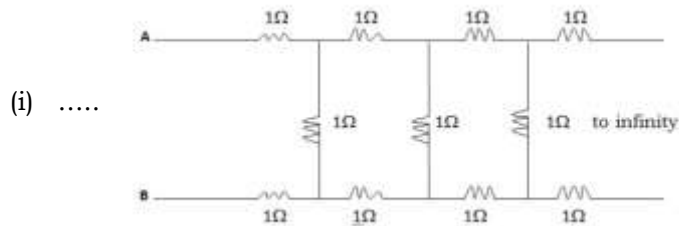
8. Attempt any one questions: (1×4=4)

- A parallel beam of light is incident on air glass interface. Using Huygen's principle and draw sketches of the wavefronts, how the wave is refracted. Prove the law of refraction.
- Draw a diagram of Foucault's method of measuring speed of light.

GROUP C

9. Attempt any two questions: (2×4=8)

- Find equivalent resistance across A and B in given combination:



- Two resistors $R_1 = 50\Omega$ and $R_2 = 40\Omega$ are placed in a series with a battery of emf 5.0 volts and internal resistance 20. A 1000Ω voltmeter is connected across 50Ω. What percentage error is made in reading the potential difference across R_1
- An electron moves around the nucleus in a hydrogen atom of radius $0.51 \times 10^{-10} \text{m}$, with a velocity of $2 \times 10^6 \text{m/s}$. Calculate (a) the equivalent current due to the orbital motion of the electron (b) magnetic field produced at the centre of the nucleus.

10. Attempt any two questions: (2×4=8)

- Electrons which have been accelerated by a potential difference of 1000V enter a co-terminus electric and magnetic field of strengths of 20V/cm and 10^{-4}T respectively. Estimate specific charge of an electron if they move undeviated through the system.

- In head on collision between alpha particle and a gold nucleus, the minimum distance of approach is $4 \times 10^{-14} \text{m}$. Calculate the energy of alpha particle. ($Z=79$ for gold)
- Monochromatic radiation of wavelength 640.2nm from a neon lamp irradiates a photo sensitive material made of tungsten. The stopping voltage is measured to be 0.54V. The source is replaced by a iron source and its 427.2nm irradiates the same photocell. Predict the stopping voltage.

11. Calculate the velocity of sound in air at 27°C. (density of air at NTP = 1.29kg/m^3 , ratio of molar specific heat capacity = 1.4)

(4)

12. In an experiment with Foucault's apparatus, the distance between the rotating and the fixed mirror is 16m, distance between the lens and the rotating mirror is 6m and the distance between the source and the lens is 2m. when the mirror is rotated at an speed of 356rev/sec, the image shifts by 0.7mm. Calculate the speed of light?

(3)

The End



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GROUP-A

1. Answer in brief, any four questions: (4×2=8)

- A fuse is a device to break a circuit, usually by melting, when the current exceeds a certain value. What characteristics should the material of the fuse have?
- Ampere's circuital law can be applied to certain case only. Does this mean that it is not true in general? Justify your answer.
- A charged particle does not gain any kinetic energy when passing through a magnetic field but it gains kinetic energy when passing through electric field. Explain, why?
- A current carrying conductor tends to contract. Why?
- Why the constantan and manganin are used as a high resistor? Give your reasons.
- If the radius of the copper wire is halved, what is the percentage change in resistance and what will happen to the resistivity?

2. Answer in brief, any four questions: (4×2=8)

- Explain why the spectrum of hydrogen atom has many lines although a hydrogen atom contains only one electron?
- Why can't metal have the hole current? Explain.
- Work function of aluminium is 4.2eV. If two photons each of energy 2.5eV are incident on its surface, will the emission of electrons take place? Explain.
- Why is clock oil used in Millikan's experiment? Can we use water in place of the clock oil?
- For the same level of doping, why is the conductivity of N-type semiconductor is greater than that of P-type semiconductor?
- Calculate the number of photons in 6.62J of radiation energy of frequency 10^{12} Hz. (given $h = 6.62 \times 10^{-34}$ Js)

3. Answer in brief, any one question: (2×1=2)

- In stationary wave, the net displacement is zero, is it true? If so, is the net energy also zero? explain.
- Show that the velocity of sound in air changes by 0.61m/s for per degree change in temperature at constant pressure.

4. Answer in brief, any one question: (2×1=2)

- Can we conclude from the interference phenomenon whether light is transverse wave or a longitudinal wave?
- What is the advantage of Foucault's method over a Michelson's method for measuring the speed of light?

GROUP B

5. Attempt any three questions: (3×4=12)

- What are Kirchhoff's laws? Derive the balanced condition for the Wheatstone bridge?
- Derive an expression for the force per unit length between two parallel conductors carrying current in the same direction and define one ampere current.
- Derive Joule's law of heating and verify it experimentally?
- What is Biot-Savart law? Derive an expression for the magnetic field produced by a straight conductor.

6. Attempt any three questions: (3×4=12)

- Show that the path of the electron in an electric field is always parabolic in nature and also find the resultant velocity of electron when it just emerges out of the plate.
- Describe Millikan's experiment to verify Einstein's photoelectric effect.
- Explain the use of a p-n junction diode as a rectifier. Draw the circuit diagram of a half wave rectifier using diodes and explain its working.
- What is physical significance of Bohr's postulate? Show that the radius of the hydrogen atom varies as n^2 .

7. Attempt any one questions: (1×4=4)

- Write Newton's formula for the velocity of sound in air. What are the factors which affect the velocity of sound? Explain in brief.
- How is a stationary wave is produced? Find the position of the node and antinode in a stationary wave?

8. Attempt any one questions:

(1×4=4)

- State Huygen's principle. Prove the law of reflection on the basis of Huygen's principle.
- Draw a diagram of Michelson's method of measuring speed of light.

GROUP C

9. Attempt any two questions:

(2×4=8)

- Two battery of 7V and 13V and internal resistance 1Ω and 2Ω respectively are connected in parallel with a resistance of 12Ω . Find the current through each branch of the circuit?
- The potential difference of 100V is applied at the two ends of a copper wire of length one metre long. Calculate the average drift velocity of the electrons. (Given, conductivity of copper = $5.81 \times 10^7 \Omega^{-1} \text{m}^{-1}$ and no. of density of copper = $8.5 \times 10^{28} / \text{m}^3$)
- A wire of 88cm carries a current of 2A which is bent into a square. Obtain the magnitude of magnetic field at the centre of the square. (Give $\mu_0 = 4\pi \times 10^{-7} \text{Hm}^{-1}$)

10. Attempt any two questions:

(2×4=8)

- If the wavelength of the incident light is reduced from 400nm to 360nm, there is change in the stopping potential of 0.34V. Find the value of Planck's constant.
- In a Millikan's oil drop experiment, a single charged drop was found to fall under the gravity at a terminal velocity of 0.0040cm/s and to rise at 0.0120cm/s when a field of $2 \times 10^5 \text{V/m}$ was suitably applied. Calculate the electronic charge, given that the radius of drop was $6 \times 10^{-7} \text{m}$ and the viscosity of the gas under the condition of the experiment was $1.8 \times 10^{-5} \text{Nsm}^2$.
- Find the number of photons emitted per second by a 25W source of monochromatic light of wavelength 6600Å. What is the photoelectric current assuming 3% efficiency for photoelectric effect. ($h = 6.625 \times 10^{-34} \text{Js}$)

11. The speed of sound in air at 20°C was found to be 344m/s. What is the change in speed of sound for 1°C change in air temperature?

(4)

12. A beam of light is reflected by a rotating mirror on to a fixed mirror which sends back to the rotating mirror from which it is again reflected and the makes an angle of 3.6° with the original direction. The distance between the two mirror is 1km and the rotating mirror is making 750rev/sec. Calculate the speed of light? (3)

The End