# PRE-BOARD EXAMINATION – 2080 (2024)

Grade: XII             F.M.: 75

Time: 3:00 hrs.     **PHYSICS (PHY. 1021)**     P.M.: 30

*Candidates are required to give their answer in their own words as far as practicable. The figures is the margin indicate full marks.*
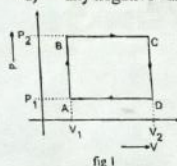**Attempt all questions.**

## GROUP A

Multiple Choice Questions.          (11×1=11)

Tick the correct answer.

1. The graph between length ($l$) and the time period (T) of simple pendulum executing simple harmonic motion is:
   a) hyperbola    b) straight line    c) circle    d) parabola

2. A circular disc is rotating with angular velocity ω. If a man standing on the edges of the disc walks towards the centre, then the angular velocity of the disc will be:
   a) Decreases      b) Increases
   c) be halved      d) not change

3. A liquid does not wet the surface of a solid if the angle of contact is:
   a) zero     b) <90°     c) >90°     d) any negative value

4. An ideal monoatomic gas is taken round the cycle ABCDA as shown in fig-1. The work done during the cycle is:
   a) $P_1V_1$         b) $(V_2 + V_1) P_2$
   c) $(V_2 - V_1)(V_2 - V_1)$ d) $(V_2 - V_1) P_2$

   fig 1

5. The law of Kelvin Planck statement about the:
   a) Conservation of energy    b) Conservation of heat
   c) Conservation of work    d) Conservation of heat into work

6. A sonometer wire is vibrating in its third overtone, then there are:
   a) 3 antinode and 4 node     b) 3 antinode and 3 node
   c) 5 node and 4 antinode     d) 5 antinode and 4 node

7. A beam of light strikes a piece of glass at an angle of incidence 60°. It is found that the reflected beam is completely plane polarized, then the refractive index of glass is:
   a) 1.5    b) $\sqrt{3}$    c) 2    d) $\frac{3}{2}$

8. If a current carrying rectangular coil PQRS is placed near the long straight current carrying conductor (Fig-2), then:
   a) net force experienced by coil is zero.
   b) net force is towards the straight conductor
   c) net force is away from the straight conductor
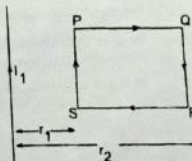   d) none of the above.

   Fig.-2

9. In the fig-3, AB is a wire of potentiometer with the increase in the value of resistance R, the shift in the balance point I will be:
   a) towards B    b) towards A
   c) remains constant   d) towards is then back towards A.

   Fig.-3

10. Area of hysteresis curve indicates
    a) Retentivity       b) coercivity
    c) loss of energy per cycle   d) Gain of energy per cycle

11. The point where the seismic waves start is called-
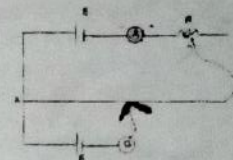    a) epicenter    b) hypocenter    c) metacenter    d) seismic center

## Group: B

Short Answer Questions.          (8×5=40)

12. a) Define the torque, show that the work done by torque in rotating body through dθ is τdθ.      [1+2]

    b) A grinding stone has moment of inertia 50 kgm². A constant couple is applied to grindstone has found to a speed of 150 rpm, 10 sec after starting from rest. Calculate torque applied.      [2]

    **OR**

    a) A bob in a simple pendulum is a hollow sphere filled with water. A small hole is bored at the bottom of the sphere, and the pendulum is made to vibrate. What happens to the time period? Explain.      [2]

    b) The displacement of an oscillating object as a function of time is as shown in fig-4. Calculate the:
       i) Time period.          [1]
       ii) Frequency and angular frequency.      [1]
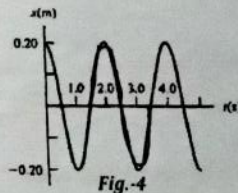       iii) Amplitude and maximum velocity.      [1]

    Fig.-4

13. a) What is angle of contact?      [1]
    b) Derive an ascent formula for liquid column in capillary tube.      [2]

    c) Three spherical rain drops of equal size are falling vertically through air with, terminal velocity of 0.150 ms⁻¹. What would be the terminal velocity if these drops were to coalesce to form a large spherical drop?      [2]

14. a) Derive an expression for work done during adiabatic process.      [3]
    b) Air is compressed adiabatically to half of it's volume. Calculate the change in it's temperature. ($\gamma = 1.4$)      [2]

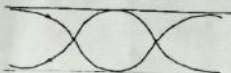a) Which mode of vibration does the figure represent and also indicate the position of node and antinodes in fig-5.

b) Obtain the frequency of the given mode of vibration in terms of fundamental frequency.

*Fig.-5*

c) If the length of given organ pipe is 50 cm. What is the fundamental frequency. [Given, velocity of sound is 350 ms$^{-1}$] [1+2+2]

**OR**

a) State Doppler's effect. [1]

b) Derive the apparent frequency of sound when an observer moves towards a stationary source. [2]

c) From the given information, as shown in figure, find the apparent frequency heard by observer, where the symbol have their usual meaning. [frequency of sound emitted by source ($f$) = 500 Hz]. [2]
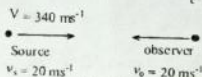
$V = 340$ ms$^{-1}$

Source    observer

$v_s = 20$ ms$^{-1}$    $v_0 = 20$ ms$^{-1}$

*Fig.-6*

16. a) What is Wheatstone bridge. [1]

b) How can we make Wheatstone bridge more sensitive? [1]

c) By using Kirchhoff's law, derive the balance condition of Wheatstone bridge. [3]

17. a) What is forward biasing in PN junction diode? [1]

b) Describe with neat diagram, the full wave rectification process by using semiconductor diodes. [3]

c) Write down the use of filter circuit. [1]

18. a) State lenz's law. [1]

b) Explain, how lenz's law is in accordance with principle of conservation of energy. [2]

c) A straight conductor of length 25 cm is moving perpendicular to it's length with a uniform speed of 10 ms$^{-1}$, making an angle 45° with a uniform magnetic field of 10 T. Calculate the emf induced across it's length. [2]

19. a) Explain the importance of carbon dating. [2]

b) Calculate the activity of 0.1 mg sample of Sr-90, whose half life period is 28 years. [3]

### Group: C

**Long Answer Questions.**

(3×8=24)

20. a) What is diffraction of light. [1]

b) Derive the condition for secondary maxima and minima in diffraction pattern due to a single slit. [3]

c) The diffraction of sound wave is more evident in daily experience then that of light waves. Why? [2]

d) A plane transmission grating has 5000 lines per cm and the second order spectral line is diffracted through 30°. Calculate the wavelength of light used. [2]

21. a) State Ampere's circuital law. [1]

b) Write it's limitations. [1]

c) Use this law to calculate the magnetic field at a point on the axis of a current carrying long solenoid. [3]

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d) A circular coil of 100 turns has a radius of 10cm and carries a current of 5A. Determine the magnetic field at a point on the axis of the coil at a distance of 5 cm from the center of the coil. [3]

**OR**

a) Discuss the advantages of AC over DC. [2]

b) Derive an expression of impedance in LCR series circuit. [3]

c) An iron cored coil of 2 H and 50 Ω resistance is placed in series with a resistor of 950 Ω and 220 V, 50 Hz ac supply is connected across the arrangement. Find:

i) the current flowing through the circuit.

ii) the voltage across the coil.

iii) the phase angle between current and voltage. [1+1+1]

22. a) Can photoelectric effect be explained on the basis of wave theory of radiation? [1]

b) Define work function. [1]

c) Describe Millikan's experiment to determine the value of planck's constant h. [3]

d) In an experiment an photoelectric effect, the graph between maximum K.E. ($E_K$) & frequency $f$ is found to be a straight line shown in fig.-7. Compute the value of threshold frequency, Planck's constant and work function. [1+1+1]
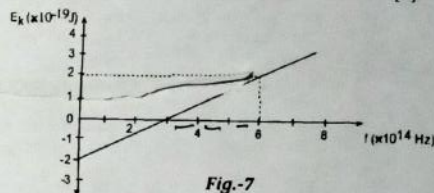
$E_k (\times 10^{-19} J)$

$f (\times 10^{14}$ Hz)

*Fig.-7*

**OR**

a) If a proton & an electron have the same speed which one has the longer de-Broglie wave length? Explain. [2]

b) Define excitation potential & ionization potential. [2]

c) In a set of experiments on a hypothetical one-electron atom, you measure the wavelength of the photons emitted from transitions ending in the ground state ($n = 1$), as shown in the energy level diagram. You also observed that it takes 17.50 eV to ionize the atom. Calculate:

i) Energy of in each levels ($n = 1, 2, 3,$ & 4) shown in the fig-8.

ii) If the electron made a transition from the $n = 4$ to the $n = 2$ level, what wavelength of light would it emit? [2+2]
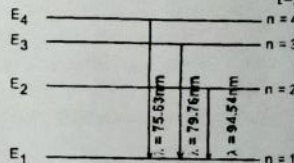
$E_4$ —— $n = 4$
$E_3$ —— $n = 3$
$E_2$ —— $n = 2$
$\lambda = 75.63$nm    $\lambda = 79.76$nm    $\lambda = 94.54$nm
$E_1$ —— $n = 1$

*Fig.-8*

◊**Best of Luck**◊