NEB - GRADE XII
2079 (2022)
Physics
(New course)

For regular students *(except technical stream)*

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

Time: 3 hrs.   **Full Marks: 75**

Attempt **all** the questions.

Group 'A'   11×1=11

Rewrite the correct options of each questions in your answer sheet.

1. If L represents momentum, I represents moment of inertia, then $\frac{L^2}{2I}$ represents

    A) Rotational kinetic energy   B) Torque   C) Power
    D) Potential energy

2. Starting from mean position, a particle in simple harmonic motion takes time T_1 and T_2 to cover first half and next half displacement in moving from mean to extreme position, then

    A) $T_1 = T_2$ B) $T_2 = 2T_1$ C) $T_1 = 2T_2$ D) $T_1 > T_2$

3. Water is flowing at 12 m/s in a horizontal pipe. If the pipe widens to twice its original diameter, the flow speed in the wider section is

    A) 6 m/s   B) 9 m/s   C) 2 m/s   D) 3 m/s

4. An ideal gas ratio of heat capacities =5/3 at 72^0C is expanded adiabatically to eight times to its original volume. Approximate rise in temperature of the gas is

    A) 86 K   B) 186 K   C) 259 K   D) 273 K

5. A carnot cycle includes

    A) Two isothermal and Two adiabatic processes.
    B) Two isothermal and Two isobaric processes
    C) Two isothermal processes
    D) Two adiabatic processes

6. The intensity of sound 'I' and amplitude of vibration 'a' are related as,

    A) $I\alpha a$ B) $I\alpha a^2$ C) $I\alpha \frac{1}{a}$ D) $I\alpha \frac{1}{a^2}$ **Contd...**

7. A diffraction grating has 400 lines/mm and is illuminated normally by a monochromatic light of wave length $6000 \overset{0}{A}$. The maximum number of diffraction maxima obtained will be

    A) 4.16   B) 4   C) 5   D) 2.96

8. Above curie temperature

    A) A ferromagnetic substance becomes paramagnetic
    B) A ferromagnetic substance becomes diamagnetic
    C) A paramagnetic substance becomes diamagnetic
    D) A paramagnetic substance becomes ferromagnetic

9. If the emf of a thermocouple, one junction of which is kept at 0^0C is given by $E = a\theta + \frac{1}{2}b\theta^2$. Then, the neutral temperature will be

    A) $\frac{a}{b}$ B) $-\frac{a}{b}$ C) $\frac{1}{ab}$ D) $-\frac{1}{ab}$

10. If power factor of an ac circuit is 0.5, then the phase difference between voltage and current is the circuit is

    A) $\frac{\pi}{3}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) π

11. In photoelectric cell, the relation between cut-off voltage (V_0) and frequency (f) of incident light is best represented by

Group 'B'   8x5=40
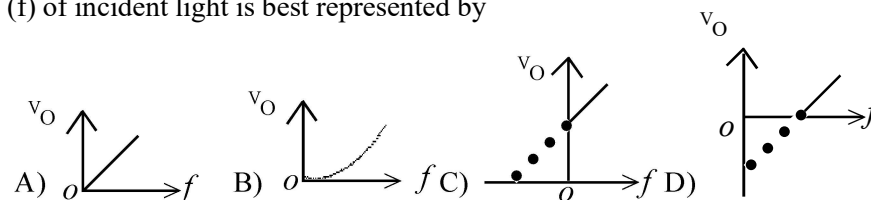
12. a) What do you mean by moment of inertia ?   1
    b) State principle of conservation of angular momentum.   1
    c) A disc of moment of inertia 5×10^{-4} kgm^2 is rotating freely about the axis through its center at 40rpm. Calculate the new revolution per minute if some wax of mass 0.02 kg dropped gently on to the disc 0.08 m from the axis.   3

                                         OR
    a) What is meant by Simple Harmonic Motion ?   1

   **Contd...**

b) Show that motion of a simple pendulum is simple harmonic and hence calculate its time period. 3

c) On what factors does the time period of simple pendulum depend ? 1

13. a) State Stoke's Law. 1

b) Describe a method to determine terminal velocity of a spherical body falling through a viscous liquid using Stoke's law 2

c) Two spherical rain drops of equal size are falling through air with terminal velocity 10 cm/s. If these two drops were to coalesce to form a single drop, what would be the new terminal velocity ? 2

14. a) What happens to the energy added to an ideal gas when it is heated at
(i) constant volume (ii) constant pressure ? 2

b) A carnot engine working between 300K and 600K has a work output of 800J per cycle. What is the amount of heat energy supplied to the engine from source per cycle ? 3

15. a) What are stationary waves ? 1

b) How stationary waves are formed in an open organ pipe ? 1

c) Sketch the wave pattern and calculate the frequencies of fundamental vibration and the first overtone for the open organ pipe of length 'L'.3

OR

a) What do you mean by Doppler's effect ? 1

b) How is it that one can recognize a friend from his voice without seeing him ? 2

c) Write down the factors on which the speed of sound in air depends. 2

16. a) What is the principle of potentiometer ? 1

b) Why is the potentiometer preferred to a voltmeter to measure the emf of a cell ? 1

c) The emf of a battery is balanced by a length 75 cm on a potentiometer wire and emf of a standard cell of 1.02 volt is balanced by a length 50 cm of it. Calculate the emf of the battery. 3

17. a) Define magnetic flux. 1

b) State Faraday's laws of electromagnetic induction 1

c) A coil has 5000 turns. What is the emf produced in the coil when the magnetic flux cutting the coil changes by 8×10^{-4} Wb in 0.1 s ? 1

d) A light aluminum ring is suspended from a long thread as shown in figure. When a strong magnet is moved away from it, the ring follows the magnet, why ? What would happen if the magnet were moved towards the ring ? 2

18. a) Why is X-rays radiation process called inverse photoelectric effect ? 2

b) State and explain Bragg's law of X-ray diffraction. 3

19. a) What is pn junction diode ? 1

b) Describe junction diode as a full wave rectifier. 3

c) Write truth table related to AND gate. 1
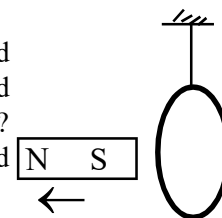
Group 'C' 8×3=24

20. The diagram represents the experimental arrangement used to produce interference fringes in Young's double slits experiment.

a) What are coherent sources of light ? 1

b) What do you mean by interference of light ? 1

c) In the above experiment, if the slits S_1 & S_2 are illuminated by a monochromatic source of light of wavelength λ, show that the width of bright fringe is equal to width of dark fringe as given by $\beta = \dfrac{\lambda D}{d}$. 4

d) If the distance between slits and the screen is doubled and slits separation is halved, what will be the effect on fringe width ? 1

e) What happened to fringe width if whole apparatus is immersed in water ? 1

21. a) State and explain Biot-Savart law. 2

b) Use this law to find the magnetic field at the center of current carrying circular coil. 3

c) A circular coil of 100 turns has a radius of 10 cm 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
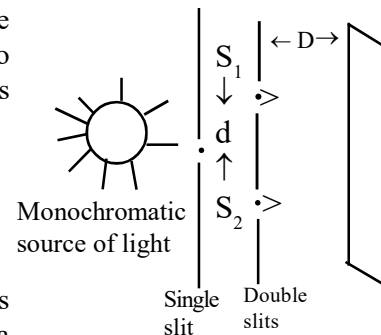
An inductor, a capacitor and a resistor are connected in series along with a source of alternating voltage.

a) Derive a relationship between the current and voltage.   3

b) Draw phasor diagram to show the lagging or leading relationship of voltage and current in the circuit connection.   2

c) In the series *LCR circuit, R= 25Ω, L=30 mH & C= 10μF.* And these elements are connected to 240 volt, 50 Hz ac source. Calculate the current in the circuit and voltmeter reading across the capacitor.   3

22. The work function of a metal is 6.4×10^{-19} J.

a) Explain what is meant by the term 'work function'.   2

b) Light with a frequency of 1.2×10^{15} Hz is shone onto the metal surface. Find whether or not the photons of this light will cause the photoelectric effect to take place. (h $= 6.62 \times 10^{-34}$ Js)   2

c) The light source is now replaced with a light source of frequency 1.5×10^{15} Hz.

i) Write down Einstein's photoelectric equation.   1

ii) The photons from the source contain more energy then is required to release the electrons. How much extra energy is available after the electron has been released ?   2

iii) Photons come from three lamps that emit red, green and blue light. Which of these lamps produces photons with the highest energy ?1

OR

a) State radioactive decay laws.   2

b) Derive the relation, $N = N_o e^{-\lambda t}$.   3

c) A sample of radioactive isotopes contains 50% of its original number in 2 year. Then

i) What is its half life ?   1

ii) If there are 10^6 such nuclei remaining after 8 years, how many numbers are there in the beginning ?   2