BOARD QUESTION PAPER : MARCH 2019
PHYSICS

Note:

i. All questions are compulsory.
ii. Draw neat, labelled diagrams wherever necessary.
iii Question paper consists of **29** questions divided into **FOUR** sections namely **A, B, C** and **D.**
iv. **Section A:** Select and write the most appropriate answer from the given alternative for Q. No.**1** to **4** of **multiple choice** type questions carrying **one mark** each and Q.No.**5** to **8** are **very short answer** type of questions carrying **one mark** each.
v. **Section B:** contains Q. No. **9** to **15** of **short answer-I** type questions carrying **two marks** each. Internal choice is provided to **only one** question.
vi. **Section C:** contains Q. No. **16** to **26** of **short answer-II** type of questions carrying **three marks** each. Internal choice is provided to **only one** question.
vii. **Section D:** contains Q. No. **27** to **29** of **long answer** type of questions carrying **five marks** each. Internal choice is provided to **each** question.
viii. For each **MCQ,** correct answer must be written along with its alphabet,
e.g., (A) ……. / (B) ……. / (C) ……. / (D) ……. etc.
ix. In case of **MCQs**, (i.e. Q. No. 1 to 4) evaluation would be done for the **first attempt** only.
x. Start each section on new page.
xi. Figures to the right indicate full marks.
xii. Use logarithmic table, if necessary. Use of calculator is **not** allowed.
xiii. Write proper units wherever necessary as per standard rules.

Physical Constants:

(1) $\pi = 3.142$
(2) Charge on proton, $e^{+} = 1.6 \times 10^{-19}$ C
(3) $h = 6.63 \times 10^{-34}$ Js
(4) $m_p = 1.67 \times 10^{-27}$ kg
(5) $c = 3 \times 10^{8}$ m/s

SECTION A

[8]

Q.1 When a sparingly soluble substance like alcohol is dissolved in water, surface tension of water (1)

(A) increases
(B) decreases
(C) remains constant
(D) becomes infinite

Q.2 The specific heat capacity of water is (1)

(A) 8R
(B) $\frac{7}{8}R$
(C) 9R
(D) $\frac{9}{7}R$

Q.3 The electric field intensity outside the charged conducting sphere of radius 'R', placed in a medium of permittivity ε at a distance 'r' from the centre of the sphere in terms of surface charge density σ is (1)

(A) $\frac{\sigma}{\varepsilon}\left(\frac{R}{r}\right)^2$
(B) $\frac{\sigma}{\varepsilon}\left(\frac{r}{R}\right)^2$
(C) $\frac{\sigma}{\varepsilon}\left(\frac{R}{r^2}\right)^2$
(D) $\frac{\varepsilon}{\sigma}\left(\frac{r}{R}\right)^2$

Q.4 An electron of energy 150 eV has wavelength of 10^{-10} m. The wavelength of a 0.60 keV electron is (1)

(A) 0.50 Å (B) 0.75 Å

(C) 1.2 Å (D) 1.5 Å

Q.5 What is the value of tangential acceleration in U.C.M. ? (1)

Q.6 What happens to a ferromagnetic substance heated above Curie temperature? (1)

Q.7 At which position of the plane of the rotating coil with the direction of magnetic field, the e.m.f. induced in the coil is maximum? (1)

Q.8 Name the logic gate which generates high output when at least one input is high. (1)

SECTION B

[14]

Q.9 In Young's experiment interference bands were produced on a screen placed at 150 cm from two slits, 0.15 mm apart and illuminated by the light of wavelength 6500 Å. Calculate the fringe width. (2)

Q.10 The susceptibility of magnetism at 300 K is 1.2×10^{-15}. What will be its susceptibility at 200 K? (2)

Q.11 The length of the second's pendulum in a clock is increased to 4 times its initial length. Calculate the number of oscillations completed by the new pendulum in one minute.

OR

A body of mass 1 kg is made to oscillate on a spring of force constant 15 N/m. Calculate (i) angular frequency (ii) frequency of vibrations. (2)

Q.12 Define capacitance of a capacitor and its S.I. unit. (2)

Q.13 Define radius of gyration. Write its physical significance. (2)

Q.14 Distinguish between p - type and n - type semiconductors. (2)

Q.15 Explain the terms (i) Transducer and (ii) Attenuation in communication system. (2)

SECTION C

[33]

Q.16 Obtain expressions of energy of a particle at different positions in the vertical circular motion. (3)

Q.17 Define binding energy and obtain an expression for binding energy of a satellite revolving in a circular orbit round the earth. (3)

Q.18 State Hooke's law. Define elastic limit and modulus of elasticity. (3)

Q.19 Obtain an expression for the rise of a liquid in a capillary tube. (3)

Q.20 Explain the reflection of transverse and longitudinal waves from a denser medium and rarer medium. (3)

Q.21 What is photoelectric effect?
Define: (i) Stopping potential (ii) Photoelectric work function (3)

Q.22 What is perfectly black body? Explain Ferry's black body. (3)

Q.23 When a resistor of 5 Ω is connected across the cell, its terminal potential difference is balanced by 150 cm of potentiometer wire and when a resistance of 10 Ω is connected across the cell, the terminal potential difference is balanced by 175 cm of the same potentiometer wire. Find the balancing length when the cell is in open circuit and the internal resistance of the cell. (3)

Q.24 A cyclotron is used to accelerate protons to a kinetic energy of 5 MeV. If the strength of magnetic field in the cyclotron is 2T, find the radius and the frequency needed for the applied alternating voltage of the cyclotron. (Given: Velocity of proton = 3×10^7 m/s) (3)

Q.25 Assuming expression for impedance in a parallel resonant circuit, state the conditions for parallel resonance. Define resonant frequency and obtain an expression for it. (3)

Q.26 Using an expression for energy of electron, obtain the Bohr's formula for hydrogen spectral lines.

OR

State the law of radioactive decay. Hence derive the relation $N = N_0e^{-\lambda t}$. Represent it graphically. (3)

SECTION D

[15]

Q.27 Show that even as well as odd harmonics are present as overtones in the case of an air column vibrating in a pipe open at both the ends. (3)

A wheel of moment of inertia 1 kg m^2 is rotating at a speed of 30 rad/s. Due to friction on the axis, it comes to rest in 10 minutes. Calculate the average torque of the friction. (2)

OR

Explain the formation of stationary waves by the analytical method. Show that nodes and antinodes are equally spaced in stationary waves. (3)

The radius of gyration of a body about an axis, at a distance of 0.4 m from its centre of mass is 0.5 m. Find its radius of gyration about a parallel axis passing through its centre of mass. (2)

Q.28 Obtain an expression for potential energy of a particle performing S.H.M. What is the value of potential energy at (i) Mean position and (ii) Extreme position. (3)

A stretched sonometer wire is in unison with a tuning fork. When the length of the wire is increased by 5%, the number of beats heard per second is 10. Find the frequency of the tuning fork. (2)

OR

From differential equation of linear S.H.M., obtain an expression for acceleration, velocity and displacement of a particle performing S.H.M. (3)

A sonometer wire 1 metre along weighing 2 g is in resonance with a tuning fork of frequency 300 Hz. Find tension in the sonometer wire. (2)

Q.29 Explain refraction of light on the basis of wave theory. Hence prove the laws of refraction. (3)

Two coherent sources of light having intensity 81:1 produce interference fringes. Calculate the ratio of intensities at the maxima and minima in the interference pattern. (2)

OR

State Brewster's law and show that when light is incident at polarizing angle, the reflected and refracted rays are mutually perpendicular to each other. (3)

Monochromatic light of wavelength 4300 Å falls on a slit of width 'a'. For what value of 'a' the first maximum falls at 30°? (2)