FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2023
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

PHYSICS, PAPER-I

TIME ALLOWED: THREE HOURS	PART-I (MCQS) MAXIMUM MARKS = 20
PART-I(MCQS): MAXIMUM 30 MINUTES	PART-II MAXIMUM MARKS = 80

NOTE:
(i) Part-II is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FOUR** questions from **PART-II**. **ALL** questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the question will not be considered.
(vii) **Use of Calculator is allowed.**

PART – II

Q. 2.
(a) What is Gradient of a scalar function? Give its physical significance and show that $\overrightarrow{Grad}\varphi = \vec{\nabla}.\varphi$ (10)

(b) Define the term 'acceleration' and find its Cartesian components.   (06)

(c) If $\vec{A} = xz^3\hat{\imath} - 2x^2z\hat{\jmath} + 2yz^4\hat{k}$, then find curl of A at the point (1,-1,1)   (04) **(20)**

Q. 3.
(a) Explain the rotational kinetic energy and determine its formula for a disc, hoop and sphere.   (10)

(b) What do you mean by the term 'inertia' in physics? Calculate respectively the rotational inertia of a solid cylinder and a hollow cylinder about an axis of symmetry.   (06)

(c) Calculate the angular speed of the second's hand, minutes hand and hour's hand of a watch.   (04) **(20)**

Q. 4.
(a) What was Physics like before relativity and how did Einstein come up with his theory? Mathematically explain how mass and energy is interchangeable?   (10)

(b) Discuss in detail the relativity of length using Einstein's special theory of relativity.   (06)

(c) Calculate the mass equivalent of energy from an antenna radiating 10KW for 24 hours.   (04) **(20)**

Q. 5.
(a) Define capillarity and derive an expression for the rise of liquid in a capillary tube to show that the height of the liquid column supported is inversely proportional to the radius of the tube.   (10)

(b) What are fluids? Write their important characteristics.   (06)

(c) A cylindrical swimming pool has radius 2m and depth 1.3m. It is filled completely with salt water.
Given, density of salt water = $1.03 \times 10^3 kgm^{-3}$, volume of water = $16.34 m^3$, and the atmospheric pressure = $1.013 \times 10^5 Pa$. Calculate the pressure at the bottom of the pool.   (04) **(20)**

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Q. 6.   **(a)**   For a wave travelling through a medium, demonstrate that the total energy per unit volume is always equal to one half the kinetic and one half the potential energy.   (10)

   (b)   The longitudinal waves can pass through solids. How it is possible and on what parameters the velocity of such waves will depend?   (06)

   (c)   The angular Vibrational frequency of CO molecule is $0.6 \times 10^{15} s^{-1}$. Calculate the amount of work required for stretching it by 0.5Å from the equilibrium position.   (04)   **(20)**

Q. 7.   **(a)**   An ideal gas is enclosed in a cylinder with movable piston. Calculate the work done on such gas and show that pressure force is non-conservative.   (10)

   (b)   State and briefly explain the intermolecular forces.   (06)

   (c)   Oxygen gas having a volume of $1130 cm^3$ at $42°C$ and a pressure of $101 kPa$ expanded until its volume is $1530 cm^3$ and its pressure is $106 kPa$. Find the number of moles of oxygen in the system and its final temperature.   (04)   **(20)**

Q. 8.   Write short notes on any TWO of the following.   **(10 each)**   **(20)**
   a.   Kepler's Law of Periods
   b.   Michelson interferometer
   c.   Young's double slit experiment

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