FEDERAL PUBLIC SERVICE COMMISSI

COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2011

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PHYSICS, PAPER-I

TIME ALLOWED:	**(PART-I MCQs)**	**30 MINUTES**	**MAXIMUM MARKS: 20**
THREE HOURS	**(PART-II)**	**2 HOURS & 30 MINUTES**	**MAXIMUM MARKS: 80**

NOTE: **(i)** **First** attempt **PART-I (MCQs)** on separate Answer Sheet which shall be taken back after 30 minutes.
(ii) **Use of scientific calculator is allowed.**
(iii) **Overwriting/cutting of the options/answers will not be given credit.**

(PART-I MCQs) (COMPULSORY)

Q.1. Select the best option/answer and fill in the **appropriate box** on the **Answer Sheet**. **(1 x 20=20)**

(i) The angular momentum of a particle moving under the influence of a central force is:
(a) Infinite (b) Negative (c) Zero (d) Constant

(ii) Transverse component of the central force acting on a particle to keep it moving along a circular path is:
(a) mv^2r (b) mv^2/r (c) Zero (d) Constant

(iii) Law of Inertia can be defined in:
(a) Accelerated system (b) Non accelerated system (c) Both (a) and (b) (d) None of these

(iv) The K.E of the particle executing a uniform circular motion:
(a) Increases (b) Decreases (c) Remains same (d) None to these

(v) What type of force acts on a raindrop to reduce its speed?
(a) Gravitational Force (b) Force of Friction (c) Electromagnetic Force (d) Drag Force

(vi) The branch of heat relating to the measurement of temperature of a body is called:
(a) Thermometry (b) Photometery (c) Ellipsometery (d) Calorimetry

(vii) Which type of ideal gas will have the largest value for $C_p - C_{vi}$?
(a) Monoatomic (b) Diatomic (c) Polyatomic (d) The value will be the same for all

(viii) What would be the most likely value for C_T, the molar heat capacity at constant temperature?
(a) Zero (b) Zero < C_T < C_V (c) C_V < C_T < C_P (d) C_T = infinite

(ix) For which of the following process the entropy change Zero?
(a) Isoberic (b) Isothermal (c) Adiabatic (d) Constant volume

(x) The zeroth law of thermodynamics helps to define the term:
(a) Temperature (b) Pressure (c) Volume (d) Density

(xi) The law of conservation of mass in fluid dynamics can be expressed as:
(a) Av = constant (b) ρAv = constant (c) $P+1/2\rho^V+\rho gy$ = constant (d) None of these

(xii) The SI units of viscosity is:
(a) $N\text{-}S/m^2$ (b) $Dynes\text{-}S/cm^2$ (c) N-S/m (d) Dynes-S/cm

(xiii) The equation of continuity requires that the total mass within certain volume must remain constant:
(a) If there are sources as well as sinks (b) If there are no sources & sinks
(c) If there are sources only (d) If there are sinks only

(xiv) If the length of the "L" and the total force acting on it is 'F' then surface tension given is:
(a) F x L (b) F . L (c) F / L (d) L / F

(xv) If the particle of liquid which pass through a certain point do not follow the same path, as that followed by the particles that passed the same point previously the liquid is said to have:
(a) Steady flow (b) Non steady flow (c) Turbulent flow (d) None of these

(xvi) The potential energy of a simple harmonic oscillator is
(a) -Kx (b) $-Kx^2$ (c) $1/2\ Kx^2$ (d) $-1/2\ Kx^2$

(xvii) Types of the mechanical waves are:

(a) Longitudinal & sound waves (b) Sound & radio waves

(c) Longitudinal & transverse waves (d) Transverse & x-rays

(xviii) The refracted ray bends towards the normal when it enters from:

(a) Rare to denser medium (b) Denser to rare medium

(c) Air to vacuum (d) None of these

(xix) On a reflection from a fixed end, a transverse wave undergoes a phase change of:

(a) 90° (b) 180° (c) 270° (d) 360°

(xx) Resolving power of a diffraction gratting can be written as:

(a) $\lambda/\Delta\lambda$ (b) $\Delta\theta/\Delta\lambda$ (c) $\Delta\lambda/\lambda$ (d) $\Delta\lambda/\Delta\theta$

PART-II

NOTE:**(i)** **PART-II** is to be attempted on separate Answer Book.

(ii) **Attempt ONLY FOUR questions from PART-II. All questions carry EQUAL marks.**

(iii) **Extra attempt of any question or any part of the attempted question will not be considered.**

Q.2. **(a)** Why do the unit vectors **i. j**. and **k** have no units? Are the unit vectors in the cylindrical and spherical coordinate system constant vectors? Explain **(**3,3,4**)**

(b) Elaborate the hybrid nature of the operator $\overline{V}$. Write the expansion of $\overline{V}\cdot\overline{V}$ **V,** where **V** is a vector quantity. **(**5,5**)**

Q.3. **(a)** Can an object be increasing in speed as its acceleration decreases? If so, give an example; if not explain why. **(**3,3,4**)**

(b) State Kepler's Law of planetary motion. An Earth satellite, in circular orbit at an altitude *h* of 230 km above the Earth's surface, has a period *T* of 89 min. What mass of the Earth follows from these data? **(**4,6**)**

Q.4. **(a)** State the relativistic effect on mass, length and time. Describe the Einstein's postulates of relativity. **(**3,3,3,3**)**

(b) What is the total energy ***E*** of a 2.53-**MeV** electron? (When an energy is used as an adjective, it refers to the kinetic energy of the particle; here ***K*** = 2.53 **MeV**.) **(**8**)**

Q.5. **(a)** State Bernoulli's Theorem. A spherical, helium-filled balloon has a radius ***R*** of 12.0 m. The balloon, support cables and basket have a mass *m* of 196 kg. What maximum load ***M*** can the balloon carry? Take density of helium = 0.160 kg/m^3 and *density of air* = 1.25 kg/m^3 **(**4,6**)**

(b) Briefly describe the concept of surface tension? How can you evaluate the surface tension of a liquid experimentally? **(**4,6**)**

Q.6. **(a)** Differentiate between the phase velocity and the group velocity. Sound waves can be used to measure the speed at which blood flows in artries and veins. Explain how? **(**4,6**)**

(b) Use Maxwell's equations to derive the electromagnetic wave equation. **(**10**)**

Q.7. **(a)** Why does the boiling temperature of a liquid increase with pressure? A bubble of 5.0 mol of helium is submerged at a certain depth in liquid water when the water undergoes a temperature increase VT of 20°C at constant pressure. As a result the bubble expands. How much heat ***Q*** is added to the helium during the expansion and temperature increase? **(**3,7**)**

(b) Two blocks of copper, the mass m of each being 850 g, are put into thermal contact in an insulated box. The initial temperatures of the two blocks are 325 K and 285 K and the constant heat c of capacity of copper is 0.386 J/g.K. What is the final equilibrium temperature T of the two blocks? **(**10**)**

Q.8. Write notes on **ANY TWO** of the following: **(**10,10**)**

(a) Michelson-Morely experiment

(b) Travelling waves and standing waves

(c) Gyroscope

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