CEPI PAKISTAN
COMPETITIVE EXAMS PREPARATORY INSTITUTE

FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION-2025 FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT

PHYSICS, PAPER-I

Roll Number

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

NOTE: (i) First attempt **PART-I (MCQs)** on separate **OMR Answer Sheet** which shall be taken back after **30 minutes.**
(ii) Overwriting/cutting of the options/answers will not be given credit.
(iii) There is **no negative** marking. All MCQs must be attempted.

PART-I (MCQs)(COMPULSORY)

Q.1. (i) Select the best option/answer and fill in the appropriate Box ■ on the **OMR Answer Sheet.(20x1=20)**
(ii) Answers given anywhere else, other than OMR Answer Sheet, will not be considered.

1. **The energy of a simple harmonic motion depends upon:**
(A) Mass (B) Frequency (C) Both (A) & (B) (D) None of these
2. **The zeroth law of thermodynamics helps to define the term:**
(A) Temperature (B) Pressure (C) Volume (D) Density
3. **What is the change in the phase if a wave is reflected from a denser medium?**
(A) 3π (B) 0 (C) π (D) 2π
4. **The light can totally pass through the polaroid only if the electric field vector vibrates _____ to the polarizing vector.**
(A) Antiparallel (B) Parallel (C) Opposite (D) None of these
5. **When the net wave intensity is greater than the individual intensities the interference of the waves is said to be.**
(A) Constructive (B) Destructive (C) Both (A) & (B) (D) None of these
6. **The angle of incidence for which polarization is maximum is called:**
(A) Scattering angle (B) Angle of reflection (C) Polarization angle (D) None of these
7. **X-rays are electromagnetic waves of wavelengths of the order of:**
(A) 1nm (B) 0.1 nm (C) 2nm (D) 100 nm
8. **The viscous force the relative motion between the adjacent layers of a fluid in motion. Which one of the flowing fits best in the sentence?**
(A) Opposes (B) Never affects (C) Facilitates (D) May effect under certain conditions
9. **The viscosity of a fluid in motion is 1 Poise. What will be it's viscosity (in Poise) when the fluid is at rest?** (A) 0 (B) 0.5 (C) 1 (D) 2
10. **For the successful operation of heat engine, which condition should be met?**
(A) Cyclic process (B) Operated at certain temperature difference
(C) Both (A) & (B) (D) None of these
11. **Which quantity is not a state function?**
(A) Internal energy (B) Pressure (C) Heat (D) Volume
12. **Fermi-Dirac statistics cannot be applied to:**
(A) Electrons (B) Photons (C) Fermions (D) Proton
13. **In which process all the heat supplied is converted into work done?**
(A) Isothermal (B) Isochoric (C) Isobaric (D) Isentropic
14. **At constant pressure and Volume, exact relation between C_p and C_v is**:
(A) $C_p > C_v$ (B) $C_p / C_v > 1$ (C) $C_p - C_v = R$ (D) All of these
15. **The internal energy of an ideal gas is _____ dependent.**
(A) Pressure (B) Temperature (C) Volume (D) All of these
16. **What is not the condition for the equilibrium in three dimensional system of axis?**
(A) $Fx=0$ (B) $Fy=0$ (C) $\sum Fz=0$ (D) $\sum F \neq 0$
17. **The tendency of rotation of the body along any axis is also called:**
(A) Moment of inertia (B) Moment of couple (C) Torque (D) Force
18. **A simple pendulum is set into oscillations. The bob of the pendulum comes to rest after some time due to:**
(A) Friction of air (B) Its mass (C) Tension in the string (D) Gravity
19. **The energy of a damped oscillator**:
(A) Decreases linearly with time (B) Increases linearly with time
(C) Decreases exponentially with time (D) Increases exponentially with time
20. **The product of mass and velocity is known as:**
(A) Work (B) Moment (C) Impulse (D) Momentum

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PART-II

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.**

Q.2. **(a)** State and prove Stoke's theorem. **(10)**
(b) Prove that if the vector is the gradient of a scalar function then its line integral around a closed curve is zero. **(6)**
(c) A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t-5$ where t is the time. Find the components of its velocity and acceleration at time t=1 in the direction 2i-3j+2k **(4)** **(20)**

Q.3. **(a)** Differentiate between Fermi-Dirac, Bose-Einstein and Maxwell-Boltzman's statistics. **(10)**
(b) What do you understand by classical statistical mechanics and quantum statistical mechanics? **(6)**
(c) A $0.5m^3$ vessel is filled with air at atmospheric pressure. The air is churned by a paddel wheel attached to a shaft 0.1m in diameter, rotating at a speed of 1800 rpm. A force of 5.0N acts on the rim of the shaft. What would be the pressure in the vessel after 10 sec of operation? **(4)** **(20)**

Q.4. **(a)** What is viscosity? Discuss effect of temperature on the viscosity of liquids and gases. **(10)**
(b) Explain why the level of mercury is down in capillary when placed in container of mercury, while it is up in the capillary in case of water? **(6)**
(c) A garden hose has an inside diameter of 2 cm and water flows through it is at 3 m/s. (i) What nozzle diameter is required for the water to emerge at 10 m/s? (ii) At what rate does the water leave the nozzle? **(4)** **(20)**

Q.5. **(a)** Discuss analytical treatment of interference of light to calculate intensity in double slit interference. Describe the conditions of maximum and minimum intensity and also draw the intensity pattern for double slit interference. **(10)**
(b) What is resolving power of a grating? Show that it increases with the order of image. **(6)**
(c) A body having SHM has an amplitude of 5cm, and a period of 0.2s. When the displacement is 5cm, find the acceleration and velocity. **(4)** **(20)**

Q.6. **(a)** What is Carnot Cycle? Draw and explain it for a reversible process. **(10)**
(b) What does Gibbs function describe? Prove that Gibbs function for a reversible isothermal and isobaric process is constant. **(6)**
(c) A heat engine absorbs 52.4 kJ of heat and exhausts 36.2 kJ of heat in each cycle. Calculate efficiency of heat engine and work done by engine per cycle. **(4)** **(20)**

Q.7. **(a)** Derive Clausius – Claypron equation and also write its two conclusions. **(10)**
(b) Prove that $TV^{\gamma-1}$=constant **(6)**
(c) Air occupying 0.142 m^3 at $2.04x10^5$ is expanded isothermally to 1 atm and then cooled at constant pressure until it reaches its initial volume. Find work done on the gas. **(4)** **(20)**

Q.8. Write Comprehensive notes on any two of the following: **(10 each)** **(20)**

(a) Newton's ring **(b)** Polarization by reflection **(c)** Doppler effect

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