



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BPS-17 UNDER
THE FEDERAL GOVERNMENT, 2010
PHYSICS, PAPER-I

Roll Number

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

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

PART – I (MCQ)
(COMPULSORY)

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

- (i) If $A = 6i - 8j$, then $4A$ has the magnitude:
(a) 40 (b) 10 (c) 20 (d) None of these
- (ii) Let $A = 2i + 6j - 3k$ and $B = 4i + 2j + k$ then $A \cdot B$ equals:
(a) $8i + 12j - 3k$ (b) 17 (c) 23 (d) None of these
- (iii) If ∇ is an operator, then $\nabla \cdot \mathbf{V}$ means:
(a) Gradient of a Scalar field (b) Curl of a vector field
(c) Divergence of a Vector field (d) None of these
- (iv) The volume of a parallelepiped bounded by Vectors A, B and C can be obtained from the expression:
(a) $(A \times B) \cdot C$ (b) $(A \cdot B) \times C$ (c) $(A \times B) \times C$ (d) None of these
- (v) A force acting on a particle is conservative if:
(a) It obeys Newton's third law (b) It obeys Newton's second law
(c) It works equals the change in Kinetic energy (d) None of these
- (vi) A torque applied to a rigid object always tends to produce:
(a) A rotational acceleration (b) A linear acceleration
(c) Precision (d) None of these
- (vii) When the velocity of a body is constant, its acceleration is:
(a) Maximum (b) Zero (c) Infinity (d) None of these
- (viii) In the absence of external torque the total angular momentum is:
(a) Constant (b) Zero (c) infinity (d) None of these
- (ix) The rate of change of Momentum of the particle is:
(a) Energy (b) Force (c) Impulse (d) None of these
- (x) Constructive and destructive superposition of waves is observed in:
(a) Polarisation (b) Interference (c) Diffraction (d) None of these
- (xi) The intensity of a wave is proportional to the square of:
(a) Amplitude (b) Time (c) Intensity (d) None of these
- (xii) The colours in soap bubbles, oil slick etc. in a thin film is due to:
(a) Diffraction (b) Polarisation (c) Interference (d) None of these
- (xiii) For higher resolution, in a diffraction grating, one needs to have:
(a) Large number of ruling (b) Small number of ruling
(c) No rulings at all (d) None of these
- (xiv) To produce interference, the sources must be:
(a) Intense (b) Incoherent (c) Coherent (d) None of these
- (xv) Interference fringes are of:
(a) Unequal width (b) Equal width (c) Variable width (d) None of these
- (xvi) A Carnot Cycle is:
(a) a rectangle on a P-V graph (b) bounded by two isotherms and two adiabatics
(c) any four sided process on a P-V graph (d) None of these
- (xvii) In an Adiabatic process:
(a) The temperature of the system remains constant
(b) The temperature of the system must change
(c) The internal energy of the system remains constant
(d) None of these

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- (xviii) A Carnot Cycle heat engine operates between 227°C and 127° C. Its efficiency is:
(a) 44% (b) 20% (c) 79% (d) None of these
- (xix) Metals pipe carrying water some times bursts in winter because:
(a) Water expands (b) Ice expands when melts
(c) Metal contracts more than water (d) None of these
- (xx) A Fahrenheit thermometer and Celsius thermometer shows the same reading at:
(a) 200° (b) -40° (c) 100° (d) None of these

PART – II

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| NOTE: | <p>(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) Extra attempt of any question or any part of the attempted question will not be considered. (iv) Use of Scientific calculator is allowed.</p> |
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- Q.2.** (a) Define a Scalar field, obtain an expression for the Gradient of a Scalar field. Why the gradient of a Scalar field is Vector? (11)
(b) Given $\Phi(x,y,z)=x^2yz^3$, find grad Φ at (1,2,1). (05)
(c) For what values of 'a', the vector $A=2i+aj+k$ and $B=4i-2j-2k$ are perpendicular. (04)
- Q.3.** (a) Distinguish between Linear and Angular Momentum. Explain the law of Conservation of Angular Momentum. Prove that the Angular momentum is constant in the absence of external torque. (14)
(b) The angular momentum J of a particle is given as $J=8t^4 i - 2t^2 j + 12t^3 k$,
Find the torque τ at $t = 1$ (06)
- Q.4.** (a) Discuss in detail the relativity of mass, time and length. (05)
(b) What is time dilation? Explain with example. (11)
(c) When we say that a clock in moving frame runs slower than a clock in a stationary frame. What does it mean? (04)
- Q.5.** (a) Differentiate between Streamline and turbulent motion of a liquid. (03)
(b) What is "Coefficient of viscosity"? Explain in detail the Stoke's law applicable in determining the coefficient of viscosity of a Viscous liquid experimentally. (14)
(c) Why do automanufacturers recommend using different viscosities of Engine oil in cold and hot climate. (03)
- Q.6.** (a) What is Polarization of light? Explain Polarization by reflection and obtain Brewster Law. Also explain the idea of double refraction. (13)
(b) We wish to use a Quartz sheet ($n=1.54$) in air as polarizer. Find the polarizing angle and angle of refraction. (05)
(c) Why can't we polarize sound waves? (02)
- Q.7.** (a) Define Internal energy. State and explain First and Third laws of thermodynamics. (14)
(b) What is a heat engine? Determine the efficiency of the engine if it takes 10,000 J of heat and delivers 2000 J of work per cycle. (06)
- Q.8.** Write notes on **ANY TWO:** (20)
(a) Centre of Mass
(b) Diffraction Grating and Resolving Power
(c) Production of low Temperature.
