



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BPS-17 UNDER
THE FEDERAL GOVERNMENT, 2009

S.No.	
R.No.	

PHYSICS, PAPER-II

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) The impedance of RLC series resonance circuit at resonant frequency is:
(a) Greater than R (b) Equal to R (c) Zero (d) None of these
- (ii) An electron has a velocity of 10km/s normal to a magnetic field of 0.1 T flux density. If the radius of the path is 569nm then the frequency is:
(a) 2.79 GHz (b) 3.1 MHz (c) 2.8 KHz (d) None of these
- (iii) If a current of 10 A flows through an electric heater for an hour and converts 8.64 MJ of electrical energy into heat energy. Then the potential difference across the heater is:
(a) 864 V (b) 240 V (c) 100 V (d) None of these
- (iv) An alpha particle is accelerated to a velocity v in a particle accelerator by a potential difference of 1200 V. Which of the following potential differences would be needed to double the velocity of the alpha particle?
(a) 2400 V (b) 3600 V (c) 4800 V (d) None of these
- (v) Two thin parallel wires carry currents along the same direction. The force experienced by one due to the other is:
(a) Parallel to the lines (b) perpendicular to the lines and attractive
(c) perpendicular to the lines and repulsive (d) None of these
- (vi) If 300 mA current is passing through an electric bulb, then the number of electrons passing through in one minute will be:
(a) 1.12×10^{20} (b) 1.6×10^{19} (c) 6.02×10^{18} (d) None of these
- (vii) An electric iron of resistance 20 Ω takes a current of 5.0 A. The thermal energy developed in 30s is:
(a) 15 kJ (b) 100 J (c) 10 J (d) None of these
- (viii) An ideal gas has a volume of exactly 1 liter at 1.00 atm and -20°C . To how many atmospheres pressure must it be subjected to be compressed to 0.500 liter at 40°C ?
(a) 5.2 atm (b) 2.47 atm (c) 1.5 atm (d) None of these
- (ix) In Bohr's model the lowest orbit corresponds to:
(a) Maximum energy (b) Minimum energy (c) Zero energy (d) None of these
- (x) The diffusion of the free electrons across the unbiased p-n junction produces:
(a) Forward bias (b) Reverse bias (c) Depletion region (d) None of these
- (xi) The P-N junction, on forward biasing acts like a:
(a) Capacitor (b) Inductor (c) Insulator (d) None of these
- (xii) The impedance at the resonant frequency of a series RLC circuits with $L = 15 \text{ mH}$, $C=0.015 \text{ F}$, and $R = 80 \Omega$:
(a) 0 $K\Omega$ (b) 30 Ω (c) 80 Ω (d) None of these
- (xiii) Weber is a unit of:
(a) Magnetic field intensity (b) Magnetic Flux
(c) Magnetic Flux Density (d) None of these
- (xiv) The magnetic flux through an element of area A in a uniform magnetic field B is expressed as:
(a) AB (b) $B \cdot A$ (c) $A \times B$ (d) None of these
- (xv) In an electric circuit, currents flowing towards a node having four branches are 2A, -3A and 4A, then the current in the fourth branch is:
(a) 2A (b) -3 A (c) 4 A (d) None of these

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- (xvi) With the passage of time, the rate of decay of a radioactive element will:
(a) Increase exponentially (b) Decrease linearly
(c) Becomes zero in two half-life time (d) None of these
- (xvii) The place where controlled fission chain reaction is carried is?
(a) A black hole (b) A star (c) A reactor (d) None of these
- (xviii) In 19th century, Faraday and Maxwell worked on the unification of two forces named as:
(a) Gravitational and Weak forces (b) Electric and magnetic forces
(c) Weak and Strong forces (d) None of these
- (xix) Electromagnetic wave theory of light was proposed by:
(a) Newton (b) Michelson (c) Maxwell (d) None of these
- (xx) The concept of field theory was put forward by:
(a) Franklin (b) Kepler (c) Orsted (d) None of these

PART – II

NOTE:	<p>(i) PART-II is to be attempted on the separate Answer Book.</p> <p>(ii) Attempt ONLY FOUR questions from PART-II. All questions carry EQUAL marks.</p> <p>(iii) Extra attempt of any question or any part of the attempted question will not be considered.</p> <p>(iv) Use of Scientific calculator is allowed.</p>
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- Q.2.** (a) State and prove Gauss law. Compare it with Coulomb's law for calculating electric field. (4+4+2)
(b) Determine the **E** field caused by a spherical cloud of electrons with a volume charge density $\rho = \rho_0$ for $0 \leq R \leq b$ (both ρ_0 and b are positive) and $\rho = 0$ for $R > b$. Sketch the charge distribution and electric field for this charge. (6+4)
- Q.3.** (a) Explain Maxwell's equations. Write the fundamental relations for electrostatic and magnetostatic models. How these were modified to Maxwell's equations? What is the main contribution of Maxwell in this regard? (4+2+4+2)
(b) Derive Maxwell's two divergence equations from its two curl equations and the equation of continuity. (4+4)
- Q.4.** (a) What are P-type and N-type semiconductors? Draw ampere-volt characteristic of a PN junction. Why there is sudden increase in the small reverse saturation current at the breakdown voltage? Write the uses of zener diode. (4+2+4+2)
(b) What are transistors? Draw the three common transistor circuits. Explain the function of transistor in the saturation mode. (2+2+4)
- Q.5.** What is Compton Effect? Derive an expression for Compton shift. How it depends upon the scattering angle? What do you mean by Red Shift? (2+8+6+4)
- Q.6.** (a) Describe Schrodinger's wave equation. Normalize $\Psi = Ae^{-\alpha x}$, where A and α are real constants, A has units of $(\text{length})^{-1/2}$ and α with units of $(\text{length})^{-2}$. (6+4)
(b) What is the probability of finding the particle described by this wave function between $x = 0.99$ and $x = 1.01$ units? Also find the possible solution for E and V .
[Given the integration from $-\infty$ to $+\infty \int_e^{-2x} dx = \sqrt{(\pi/2)}$] (4+6)
- Q.7.** (a) Explain Radioactive decay. Find an expression for decay rate. Relate half life to the disintegration constant. What are the units for the measurement of radioactivity? (4+6+2+2)
(b) A 2.71g sample of radioactive KCl is decaying at a constant rate of 440 Bq into the isotope ^{40}K , which constitutes 1.17% of the normal potassium. Calculate the half-life of this nuclide. (6)
- Q.8.** Write short notes on **ANY TWO** of the followings: (10,10)
(i) Poynting theorem and Poynting vectors
(ii) Elementary particles and their properties
(iii) Unification of forces.
