

KHYBER PAKHTUNKHWA PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR THE POSTS OF PMS-2018

PAPER PHYSICS-I

Time Allowed: 03 Hours

Max. Marks: 100

NOTE: Attempt any FIVE complete questions.

Q.1 (a) Show that $\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$ and

$$\vec{A} \times \vec{B} = (A_y B_z - A_z B_y)\mathbf{i} - (A_x B_z - A_z B_x)\mathbf{j} - (A_x B_y - A_y B_x)\mathbf{k} \quad (10)$$

(b) Two vectors A and B have components in arbitrary units, $A_x = 3.1$, $A_y = 1.5$

$B_x = 0.50$, $B_y = 4.5$. Find the angle between A and B. (6)

(c) Do the Commutative and Associative laws apply to vector subtractions? (4)

Q.2 (a) A net unbalanced force applied to a particle will change its state of motion

by accelerating from initial velocity v_i to final velocity v_f . What is the effect of the work done on the particle by this unbalanced force? (10)

(b) A running man has half the kinetic energy of a boy who has half the mass of the man. The man speeds up by 1.0 m/s and then has the same kinetic energy as the boy has. What were the original speeds of the man and the boy? (7)

(c) Does kinetic energy depend on the frame of reference of the observer? Does its value depend upon the direction of the moving body? Can it be negative? (3)

Q3. (a) What is Einstein special theory of relativity? On the basis of its postulates, explain time dilation and length contraction phenomenon. (4, 4, 4)

(b) A rod of length L starts moving with certain velocity such that its length becomes half of the original length. Calculate the velocity of the rod. (6)

(c) There is two observers in two different frames of reference. Each of them carry identical bat held along the direction of their relative motion. Each one measures, other bat is shorter. Explain the reason for such paradox. (2)

Q4. (a) What do you understand by Simple Harmonic Motion? Plot the force and potential energy of the simple harmonic oscillator w.r.t displacement. (10)

(b) A meter stick swinging from one end oscillates with a frequency f_0 . What would be the frequency in terms of f_0 , if the bottom third of the stick is cut off. (8)

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- (c) What changes can be you make in a Harmonic Oscillator that would double the speed of oscillating object? (2)
- Q5. (a) Explain construction and working of Michelson's interferometer. How fringe shift is calculated? (10)
- (b) Find the slit separation of a double slit arrangement that will produce bright interference fringes 1° apart in angular separation. Take wavelength equal to 590nm. (6)
- (c) Is Coherence important in reflection and refraction? (4)
- Q6. (a) An unpolarized light falls on two polarizing sheets so oriented that no light is transmitted. If a third polarizing sheet is placed between them, light is transmitted. Calculate the intensity of the transmitted light. (10)
- (b) At what angle of incidence light reflected from water will be completely polarized? Does this angle depend on wave length of light? (8)
- (c) Can sound waves be polarized? (2)
- Q7. (a) The speed of sound in different gases at the same temperature depends on the molar mass of the gas. Show that, at constant temperature, $\frac{V_1}{V_2} = \sqrt{\frac{M_2}{M_1}}$ where V_1 is the speed of sound in gas of molar mass M_1 and V_2 is the speed of sound in gas of molar mass M_2 . (10)
- (b) At what temperature is the average translational kinetic energy of a molecule in an ideal gas equals to 10 eV. (6)
- (c) If hot air rises, why it is cooler at the top of the mountain than near sea level. (4)
- Q8. (a) Give two important statements of second law of thermodynamics and show that they are equal. (10)
- (b) A heat engine absorbs 52.4 kJ of heat and exhausts 36.2 kJ of heat in each cycle. Calculate efficiency and work done by engine per cycle. (6)
- (c) Are there natural processes which are reversible? (4)