RUBRICS: HSSC 1ST ANNUAL EXAMINATION 2024
SUBJECT: PHYSICS HSSC-I (PAPER-D)

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	
2(i)	Explaining the main principle behind the use of ultrasound to obtain diagnostic information about internal structure.	Correct explanation e.g. explaining that an ultrasonic signal is transmitted through a patient. By the analysis of reflected or refracted signals, we can diagnose the issues. (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
OR 2(i)	Explaining the reason for a cricket player retracting his hands while catching the ball	Correctly explaining that it increases the time and reduces the force w.r.t. relations of impulse (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
2(ii)	To show that $\vec{A}$ and $\vec{B}$ are of the same magnitude If $(\vec{A}+\vec{B})$ and $(\vec{A}-\vec{B})$ are perpendicular to each other	Correct proof (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
OR 2(ii)	Explaining the effect on the energy of waves when two waves traveling in opposite directions cancel each other completely	Correct explanation involving that energy is converted into heat energy, transfers to particles of the medium as K.E. and P.E. (03)	Partially correct explanation (02)	Some relevant information (01)	Wrong answer (0)		
2(iii)	Explaining the process of creating artificial gravity to overcome weightlessness	Correctly explaining including spinning of spaceship, action of centripetal and centrifugal forces, centripetal acceleration as gravitational acceleration using relations (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
OR 2(iii)	Showing that following equation is homogeneous with respect to dimensions: (i) $a_c = \dfrac{v^2}{r}$	Correct proof (1.5)	Partially correct (01)	Some relevant mathematical step (0.5)	Wrong answer (0)		
	Showing that following equation is homogeneous with respect to	Correct proof (1.5)	Partially correct (01)	Some relevant mathematical step	Wrong answer (0)		

				(0.5)			
	(ii) $E = mc^2$						
2(iv)	Explaining the reason that kinetic energy of system does not remain constant in inelastic collision	Correctly explaining i.e. K.E. is dissipated as heat and sound energy during inelastic collision (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
OR 2(iv)	Showing that $S = v_i t + \frac{1}{2} at^2$ is dimensionally consistent.	Correct proof (03)	Partially correct either correct LHS or RHS or sufficiently correct steps on both sides (02)	Some relevant step (01)	Wrong answer (0)		
2(v)	Differentiating between radian and steradians.	Correctly writing any two differences (02)	Correctly writing any one difference (01)	Some relevant information (0.5)	Wrong answer (0)		
	Showing that number of steradians in sphere are equal to $4\pi \, Sr$.	Correct proof (01)	Some relevant information (0.5)	Wrong answer (0)			
OR 2 (v)	1ˢᵗ condition of equilibrium with mathematical expressions.	Correctly written statement of condition with mathematical formula (1.5)	Partially correct i.e. correctly written statement or formula (01)	Some relevant information (0.5)	Wrong answer (0)		
	2ⁿᵈ condition of equilibrium with mathematical expressions.	Correctly written statement of condition with mathematical formula (1.5)	Partially correct i.e. correctly written statement or formula (01)	Some relevant information (0.5)	Wrong answer (0)		
2(vi)	Showing that the angles of projection, that exceed or fall short of 45° by equal amount, ranges are equal.	Correctly deriving both case for angle exceeding 45 degrees or falling short of 45 degrees with result. (03)	Partially correct i.e. correctly deriving any one case for angle exceeding 45 degrees or falling short of 45 degrees (02)	Some relevant mathematical step (01)	Wrong answer (0)		
OR 2(vi)	Showing that work done can be calculated from the area under force-displacement graph	Correct derivation with labelled graph (03)	Partially correct (02)	Some relevant mathematical step or information (01)	Wrong answer (0)		
2(vii)	Differentiating between renewable and non-renewable energy sources.	Correctly writing any three differences (03)	Correctly writing any two differences (02)	Correctly writing any one difference (01)	Wrong answer (0)		
OR 2(vii)	Explaining moment of inertia of body	Correctly explaining moment of inertia OR correctly writing definition, formula, unit (1.5)	Partially correct (01)	Some relevant information (0.5)	Wrong answer (0)		
	Explaining angular momentum of body	Correctly explaining moment of inertia OR correctly writing definition, formula, unit (1.5)	Partially correct (01)	Some relevant information (0.5)			

2(viii)	Differentiating between absolute uncertainty and percentage uncertainty with examples.	Correctly writing any three differences e.g. definitions, formula, examples etc. (03)	Correctly writing any two differences (02)	Correctly writing any one difference (01)	Wrong answer (0)		
OR 2(viii)	Elaborating the work done by centripetal force.	Correctly explaining that no work is done by centripetal force with mathematical proof (03)	Partially correct (02)	Correct response i.e. no work is done or some correct mathematical steps (01)	Wrong answer (0)		
2(ix)	Angular velocity of an electric motor turns at 200rpm.	Correct calculation with correct answer i.e. 21 rad/s (1.5)	Partially correct (01)	Some relevant mathematical step (0.5)	Wrong answer (0)		
	Calculating angular displacement after 5seconds	Correct calculation with correct answer i.e. 105 rad (1.5)	Partially correct (01)	Some relevant mathematical step (0.5)	Wrong answer (0)		
OR 2(ix)	Explaining the reason for floating of clouds in air	Correctly explaining e.g. giving reason of their small terminal velocity w.r.t. formula (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
2(x)	Calculating speed of efflux through a hole. A small circular hole 4.00mm in diameter is cut in the side of a large water tank, 12m below the water level in the tank.	Correct calculation with correct answer i.e. 15.3 m/s (1.5)	Partially correct (01)	Some relevant mathematical step (0.5)	Wrong answer (0)		
	Calculating the flow rate of water through the hole	Correct calculation with correct answer i.e. 1.92 x 10^{-4} m^3/s(1.5)	Partially correct (01)	Some relevant mathematical step (0.5)	Wrong answer (0)		
OR 2(x)	Explaining any two applications of resonance.	Correctly explaining any two applications e.g. tuning of radio, working of microwave oven etc (03)	Partially correct e.g. correctly explaining any one application (02)	Some relevant information (01)	Wrong answer (0)		
2(xi)	Explaining the detection of ultrasonic waves by using piezoelectric method	Correctly explaining the reason. As ultrasonic waves consisting of compressions and rarefaction so when they are allowed to fall on a quartz crystal, a certain Potential difference is produced across the crystal	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		

		faces. This potential difference is amplified by an amplifier and the ultrasonic waves are detected. (03)					
OR 2(xi)	Discussing the necessary conditions for detectable interference of light.	Correctly writing any three conditions e.g. The interfering beams must be monochromatic. The interfering beams of light must be coherent. The sources should be narrow and very close to each other. The intensity of the two sources be comparable. (03)	Correctly writing any two correct conditions mentioned in level-1 (02)	Correctly writing any one correct condition mentioned in level-1 (01)	Wrong answer (0)		
2(xii)	Explaining the function of moveable plane mirror used in Michelson's interferometer.	Correctly explaining the working of movable mirror e.g. In a Michelson interferometer, the movable mirror alters the optical path length of one of the light beams. This change in path length affects the interference pattern observed at the detector, allowing precise measurement of wavelengths, small distances, or changes in refractive index. (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
OR 2(xii)	Explaining the energy degradation in all natural processes	Correct explanation including less availability of useful energy due to increase in entropy according to 2nd law of thermodynamics. (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
2(xiii)	Explaining the reason that molar specific heat at constant pressure is greater than molar specific heat	Correctly explaining the reason including more heat is required at constant pressure because	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		

		at constant volume	given heat is used to increase the internal energy and do some work while at constant volume, all the given heat is used to increase the internal energy with mathematics (03)					
OR 2(xiii)	Explaining that effect of taking Young's double slit experiment apparatus from air into water,	Correctly explaining the reason including the interference fringes become closer together due to the reduced wavelength of light in water. This happens because light travels slower in water than in air. (03)	Partially correct (02)	Some relevant mathematical step (01)	Wrong answer (0)			
2(xiv)	Writing two statements of second law of thermodynamics.	Corectly writing any two statements from Kelvin statement, Clausius statement, statements in term of entropy. (03)	Correctly writing any one statement (02)	Some relevant information (01)	Wrong answer (0)			
OR 2(xiv)	Explaining the factors which can increase the fringe width in Young's double slit experiment	Correctly explaining that fringe width increases by using light of long wavelength, increasing the distance between slits (or sources of light) and screen and decreasing the distance between slits using formula (03)	Correctly writing any two points mentioned in level-1 (02)	Correctly writing any one point mentioned in level-1 (01)	Wrong answer (0)			
Q. 3	Definition of vector product with mathematical relation and figure	Correctly writing definition of vector product, complete formula and figure (03)	Correctly writing any two points mentioned in level-1 (02)	Correctly writing any one point mentioned in level-1 or some relevant information (01)	Wrong answer (0)			
	Writing characteristics of vector product.	Correctly writing at least two characteristics (04)	Sufficiently correct characteristics (03)	Partially Correct (02)	Some relevant information (01)	Wrong answer (0)	
OR Q. 3	Initial description with figure of elastic collision in one-dimension to show that velocity of approach is equal to velocity of separation.	Correct writing initial description with figure (02)	Partially correct (01)	Wrong answer (0)				

	Use of laws of conservation of K.E. and momentum	Correctly using the laws of conservation of K.E. and linear momentum to get required equations (02)	Partially correct (01)	Wrong answer (0)		
	Rearranging the equations to obtain the final result	Correctly rearranging the equations to get the final result (03)	Sufficiently correct i.e. three correct mathematical steps after laws of conservations (02)	Partially correct (01)	Wrong answer (0)	
Q. 4	Stating Bernoulli's equation for ideal fluid flow.	Correct statement (01)	Partially correct (0.5)	Wrong answer (0)		
	Figure for Bernoulli's equation	Correctly labelled figure (01)	Partially correct (0.5)	Wrong answer (0)		
	Deriving Bernoulli's equation	Correct derivation including derivation of total work done and final result (04)	Sufficiently correct derivation (03)	Partially correct derivation e.g. correct derivation of total work done or some correct mathematical steps (02)	Any relevant mathematical step (01)	Wrong answer (0)
OR Q. 4	Writing construction of simple pendulum	Correctly writing construction (01)	Partially correct (0.5)	Wrong answer (0)		
	Figure of simple pendulum showing forces at extreme position	Correct labelled figure (01)	Partially correct (0.5)	Wrong answer (0)		
	Proof of motion of simple pendulum as SHM	Correct derivation including maths and discussion of Wx=T , restoring force= - Wy, calculation of acceleration and final mathematics (04)	Correctly writing any three points (03)	Correctly writing any two points (02)	Some relevant information (01)	Wrong answer (0)
Q. 5	Definition of absolute P.E.	Correct definition (02)	Partially correct (01)	Wrong answer (0)		
	Labelled figure	Correct labelled figure (01)	Partially correct (0.5)	Wrong answer (0)		
	Derivation of an expression for absolute potential energy.	Correct derivation i.e. correctly calculated "r", work done in first step, total work done from 1 to infinity, deriving the final formula of absolute P.E. (04)	Sufficiently correct derivation e.g. correctly writing any two steps mentioned in level-1 (03)	Partially correct e.g. correctly writing any one step mentioned in level-1 (02)	Some relevant information (01)	Wrong answer (0)

OR Q. 5	Showing that $a_c = \dfrac{v^2}{r}$.	Correct derivation (03)	Partially correct e.g. involving three mathematical steps (02)	Some relevant information (01)	Wrong answer (0)		
	Deriving relation between centripetal force and centripetal acceleration.	Correct derivation from F= ma to F = mv²/r (03)	Partially correct (02)	Any relevant mathematical step (01)	Wrong answer (0)		
	Labelled figure	Correct labelled figure (01)	Partially correct (0.5)	Wrong answer (0)			
Q. 6	Explaining variation in speed of sound in air with temperature	Correct explanation with the help of formula (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
	To show that $V_t = V_0 + 0.61t°C$	Correctly deriving the formula (03)	Partially correct e.g. any four correct mathematical steps (02)	Some relevant mathematical steps (01)	Wrong answer (0)		
OR Q. 6	Working principle of Carnot's engine	Correctly explaining the four processes of Carnot cycle (04)	Correctly explaining the three processes of Carnot cycle (03)	Correctly explaining the two processes of Carnot cycle (02)	Correctly explaining the one process of Carnot cycle (01)	Wrong answer (0)	
	Labelled graph	Correctly labelled graph (02)	Partially correct graph (01)	Wrong answer (0)			

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2(i)	Describing the conditions for two or more sources of light to behave as coherent sources	Correctly writing three conditions e.g. The sources which produce waves having i. The same frequency ii. Equal or comparable amplitude iii. Constant phase difference (03)	Correctly describing any two points mentioned in level 1 (02)	Correctly describing any one point mentioned in level 1 (01)	Wrong answer (0)		
OR 2(i)	Brief explanation of the fact that flash of lightning is seen earlier than the thunder	Correctly explaining that it is due to greater speed of light than speed of sound (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		
2(ii)	Differentiation between precision and accuracy.	Correctly writing any three differences (03)	Correctly writing any two differences (02)	Correctly writing any one point (01)	Wrong answer (0)		
OR 2(ii)	Show that: $\left| \vec{A} \times \vec{B} \right|^2 + \left| \vec{A}.\vec{B} \right|^2 = A^2 B^2$	Correct proof (03)	Correctly writing any two steps (02)	Correctly writing any one step (01)	Wrong answer (0)		
2(iii)	Describing conditions for a vector to have components that are equal in magnitude	Correctly describing the condition that vectors makes angle of 45° with x-axis (02)	Partially correct (01)	Wrong answer (0)			
	Figure of a vector having equal magnitude components	Correctly drawn figure (01)	Partially correct (0.5)	Wrong answer (0)			
OR 2(iii)	Describing the limitations of dimensional analysis.	Correctly writing any three points (03)	Correctly writing any two points (02)	Correctly writing any one point (01)	Wrong answer (0)		
2(iv)	For a projectile showing that: $R = R_{max} \, Sin \, 2\theta$	Correct proof (03)	Partially correct (02)	Correctly writing one step (01)	Wrong answer (0)		
OR 2(iv)	Differentiating between conservative and non-conservative forces.	Correctly defining conservative and non conservative forces with the help of two examples of each	Partially correct (02)	Some relevant information (01)	Wrong answer (0)		

		(03)				
2(v)	Showing that the given equation is dimensionally consistent: $2as = v_f{}^2 - v_i{}^2$	Correct proof (03)	Partially correct (either correct LHS or RHS or sufficiently correct steps on both sides) (02)	Correctly writing one step (01)	Wrong answer (0)	
OR 2 (v)	A machine needs $500J$ of energy to raise 5 kg block at distance of $3.0m$ .Finding the efficiency of machine.	Correctly calculating output (147J) and efficiency of machine (29%) (03)	Partially correct (02)	Some relevant steps (01)	Wrong answer (0)	
2(vi)	Differentiate between radian and steradians.	Correctly writing any two differences (02)	Correctly writing any one difference (01)	Some relevant information (0.5)	Wrong answer (0)	
	Showing that number of steradians in sphere are equal to $4\pi\ Sr$.	Correct proof (01)	Some relevant information (0.5)	Wrong answer (0)		
OR 2(vi)	Describing angular displacement.	Correctly defining angular displacement (01)	Some relevant information (0.5)	Wrong answer (0)		
	Describing angular acceleration.	Correctly defining angular acceleration (01)	Some relevant information (0.5)	Wrong answer (0)		
	Description of angular displacement in radian.	Correctly writing any information about angular displacement in radian e.g. defining radian, figure showing angle in radian etc. (01)	Some relevant information (0.5)	Wrong answer (0)		
2(vii)	Briefly explaining the equation $\tan\theta = \frac{v^2}{rg}$, relating banking angle 'θ' to speed 'v' and radius of curvature 'r'.	Correctly explaining the equation with figure OR correct proof of the equation with figure (03)	Partially correct proof (02)	Some relevant information (01)	Wrong answer (0)	
OR 2(vii)	Explaining the reason of suspension of fog droplets in air.	Correctly explaining the reason with formula that fog droplets have small mass/weight OR small radius, that's why have small terminal velocity (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	
2(viii)	Calculating the moment of inertia of a $50kg$ sphere whose radius is $25cm$?	Correct calculation of moment of inertia with correct answer in SI units (1.25 kgm²) (03)	Partially correct (02)	Some relevant steps (01)	Wrong answer (0)	
OR 2(viii)	Calculating the flow rate of water through a certain pipe of a cross-sectional	Correct calculation of flow rate of water with correct answer in SI	Partially correct (02)	Some relevant steps (01)	Wrong answer (0)	

	area of $0.0002 m^2$ in which water is flowing at $5m/s$.	units (0.001 m³s⁻¹ OR 10^{-3} m³s⁻¹) (03)				
2(ix)	Explaining the reason of weightlessness in artificial satellite.	Correctly explaining the reason that orbiting satellite is a freely falling body, its apparent weight becomes zero, that's why it is in weightlessness (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	
OR 2(ix)	Finding the speed of waves in a ripple tank when 20 waves passes through a certain point in one second and the wave length of wave is $4cm$.	Correct calculation of speed of waves with correct answer in SI units (0.8 ms⁻¹) (03)	Partially correct (02)	Some relevant steps (01)	Wrong answer (0)	
2(x)	Describing the effect of frequency of a forced oscillation on the amplitude with frequency near to the natural frequency of the systems with graph	Correctly explaining effect of frequency on the amplitude near the natural frequency with the concept of sharpness of resonance with correctly labelled graph (03)	Partially correct i.e. correct explanation OR correctly labelled graph OR sufficiently correct explanation with partially correct graph (02)	Some relevant information (01)	Wrong answer (0)	
OR 2(x)	Briefly explaining effect of variation of pressure on speed of sound in air	Correctly explaining that there is no effect of variation in pressure on speed of sound with the help of mathematical relations (03)	Partially correct explanation (02)	Some relevant information (01)	Wrong answer (0)	
2(xi)	Briefly explaining Brewster's law of polarization.	Correctly describing the statement, mathematical calculation of polarizing angle and correctly labelled figure (03)	Partially correct e.g. describing any two points mentioned in level-1 (02)	Some relevant information (01)	Wrong answer (0)	
OR 2(xi)	Calculating work done by a thermodynamic system during volume change.	Correctly proving that work done W= PΔV with figure (03)	Partially correct proof (02)	Some relevant step/ information (01)	Wrong answer (0)	
2(xii)	Briefly explaining that the systems tend to become less orderly over time.	Correctly explaining the fact using second law of thermodynamics in term of entropy OR explaining with the help of example that systems tend to go in a direction of increase in entropy (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	

OR 2(xii)	Briefly explaining diffraction of x-rays through crystals.	Correctly writing the Bragg's relation with the help of figure OR explaining the condition of diffraction of x-rays by crystals OR describing Laue experiment with figure (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	
2(xiii)	Explaining the formation of colour patterns in thin films due to interference of light.	Correctly explaining the reason that it is due to interference of light when white light falls on thin film, it shows colours due to destructive interference of one of the seven colours and remaining six colours are seen in thin film (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	
OR 2(xiii)	Determining the two complementary angles at which the horizontal ranges of two projectiles become equal when velocity of projections and the acceleration due to gravity are kept constant.	Correctly calculating that ranges of projectile will be equal by taking any two complementary angles OR by using any correct mathematical derivation (03)	Partially correct (02)	Some relevant mathematical step (01)	Wrong answer (0)	
2(xiv)	Briefly explaining the adiabatic process by using first law of thermodynamics.	Corectly writing any three points mentioned below: i. Correct definition ii. Writing equation PV^γ= constant iii. Writing its equation for first law of thermodynamics iv. Equation of adiabatic compression (heating), v. Equation of adiabatic expansion (cooling) vi. Drawing the PV graph (03)	Correctly writing any two points mentioned in level-1 (02)	Correctly writing any one point mentioned in level-1 (01)	Wrong answer (0)	
OR 2(xiv)	Defining impulse	Correctly defining impulse (01)	Partially correct (0.5)	Wrong answer (0)		
	Explaining the relation between impulse acting on a body with its	Correct proof (impulse(J or I) = change in momentum (ΔP) OR complete explanation with	Partially correct (01)	Wrong answer (0)		

	momentum.	example (02)				
Q. 3	Explanation of addition of number of vectors (N-vectors) by using rectangular components method.	Correctly describing the addition of N- vectors by using rectangular components with its five steps (05)	Correctly describing any four steps of addition of N- vectors by rectangular components OR sufficiently correct (04)	Correctly describing any three steps of addition of N-vectors by rectangular components OR partially correct (03)	Correctly describing any two steps of addition of N- vectors by rectangular components (02)	Some relevant information (01)	Wrong answer (0)
	Illustrate with diagram.	Correctly labelled figure (02)	Partially correct (01)	Wrong answer (0)			
OR Q. 3	What is meant by projectile motion? Explain in detail.	Correctly defining projectile motion with brief explanation e.g. explaining velocities along x-axis and y-axis OR explaining instantaneous velocity and direction OR explaining motion under gravity and inertia (02)	Partially correct (01)	Wrong answer (0)			
	Figure of projectile motion	Correctly labelled figure (01)	Partially correct (0.5)	Wrong answer (0)			
	Deriving formula of height of projectile	Correct derivation (02)	Partially correct (01)	Wrong answer (0)			
	Deriving formula of time of flight	Correct derivation (02)	Partially correct (01)	Wrong answer (0)			
Q. 4	Description of Bernoulli's equation for ideal fluid flow.	Correct statement OR Correct brief description (01)	Partially correct (0.5)	Wrong answer (0)			
	Figure of Bernoulli's equation	Correctly labeled figure (01)	Partially correct (0.5)	Wrong answer (0)			
	Deriving Bernoulli's equation	Correct derivation including derivation of total work done and final result (04)	Sufficiently correct derivation (03)	Partially correct derivation e.g. correct derivation of total work done or some correct mathematical steps (02)	Any relevant mathematical step (01)	Wrong answer (0)	
OR Q. 4	Calculation of K.E. in energy conservation in SHM.	Calculation of K.E. (02)	Partially correct (01)	Wrong answer (0)			

	Calculation of P.E. in energy conservation in SHM.	Calculation of P.E. (02)	Partially correct (01)	Wrong answer (0)		
	Calculation of total energy in energy conservation in SHM.	Calculation of Total energy with brief discussion for energy conservation OR graph showing K.E. and P.E. (02)	Partially correct (01)	Wrong answer (0)		
Q. 5	Work done along first path to show that the work done in gravitational field is independent of path followed.	Correct derivation of work done along first path (03)	Partially correct (02)	Some relevant information (01)	Wrong answer (0)	
	Work done along second path to show that the work done in gravitational field is independent of path followed.	Correct derivation of work done along second path (03)	Partially correct (02)	Some relevant mathematical steps (01)	Wrong answer (0)	
	Final result to show that the work done in gravitational field is independent of path followed.	Correctly describing the result (01)	Partially correct (0.5)	Wrong answer (0)		
OR Q. 5	Definition of orbital velocity of satellite	Correct definition (02)	Partially correct (01)	Wrong answer (0)		
	Derivation of orbital velocity of satellite	Brief initial description and correct derivation using gravitation force and centripetal force and writing the result in term of gravitational constant, mass of Earth and orbital radius (04)	Sufficiently correct e.g. correctly writing at least three mathematical steps (03)	Partially correct (02)	Any relevant mathematical step (01)	Wrong answer (0)
	Figure for orbital velocity of satellite	Correctly labelled figure (01)	Partially correct (0.5)	Wrong answer (0)		
Q. 6	Explain Doppler effect on	Correctly describing and deriving	Partially correct (02)	Some relevant	Wrong answer (0)	

	the basis of principle of superposition. (Case-I)	when source is moving towards the observer OR when observer is moving towards the source OR when source and observer are moving towards each other (03)		mathematical steps (01)			
	Explain Doppler effect on the basis of principle of superposition. (Case-II)	Correctly describing and deriving when source is moving away from the observer OR when observer is moving away from the source OR when source and observer are moving away from each other (03)	Partially correct (02)	Some relevant mathematical steps (01)	Wrong answer (0)		
OR Q. 6	Calculating of heat energy at constant volume and internal energy	Correct calculation involving derivation of $Qv = C_v \, \Delta T$ and internal energy (03)	Partially correct with at least two correct mathematical steps (02)	One correct mathematical step (01)	Wrong answer (0)		
	Derivation of final result $Cp - Cv = R$	Correct proof using first law of thermodynamics, general gas equation etc. (03)	Partially correct with at least two correct mathematical steps (02)	One correct mathematical step (01)	Wrong answer (0)		