ARNAV PANT

SS1-B

GYAN BHARATI SCHOOL
Half Yearly Examination (2016-2017)
Class-SS-1 A and B
Subject-Physics

Time allowed:3hrs **M.M:70**

General instructions:

(1) There are twenty six questions in the question paper. All questions are compulsory with an internal choice in one question of two marks, one question of three marks and all questions of five marks.
(2) Question numbers 1-5 are very short answer type questions, carrying one mark each.
(3) Question numbers 6to 10 are short answer type questions, carrying two marks each
(4) Question numbers 11 to 22 are also short answer type questions, carrying three marks each. Question 23 carries four marks.
(5) Question numbers 24 to 26 are long answer type questions, carrying five marks each.
(6) Use of calculators is not permitted. However, you may use log tables, if necessary.

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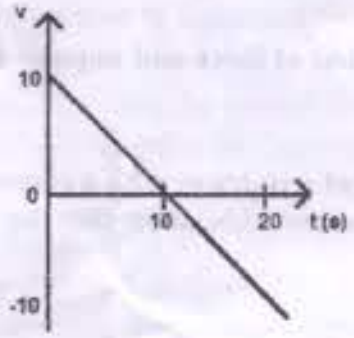
Q1. Two masses M_1 and M_2 separated by distance r start moving towards each other due to their own force of attraction. What will be the change in centre of mass? (1)

Q2. Name one quantity with (i) same dimensions (ii) constant value having dimension. (1)

Q3. What can you say about the nature of acceleration, associated with a mass whose v-t graph is shown? (1)



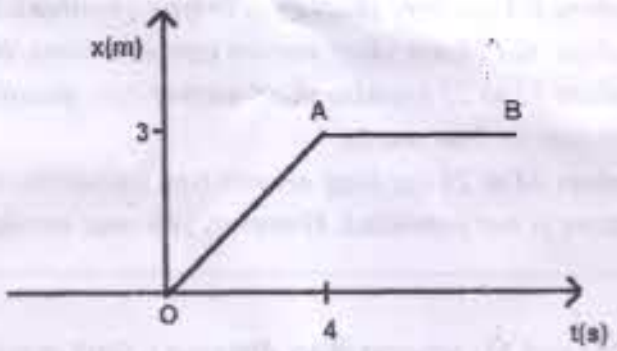
Q4. Can the overall energy of a body be negative? Why? (1)

Q5. A body is dropped from the ceiling of a transparent cabin falling freely towards the earth. Describe the motion of the body as observed by an observer (i) sitting in the cabin (ii) standing on the earth. (1)

Q6. An object is moving with uniform acceleration. Its velocity after 5 seconds is 25 m/s and after 8 seconds, it is 34 m/s, Find the distance travelled by the object in 12^{th} second. (2)

Q7. What is the advantage of the concept of centre of mass? Should the centre of mass of a body necessarily lie inside the body? (2)

Q8. Figure shows the position—time graph of a particle of mass 4 kg. What is the (i) force acting on the particle for $t < 0$, and $t >> 4$ s ? (ii) impulse at $t = 4$ s? Assume that the motion is one dimensional. (2)



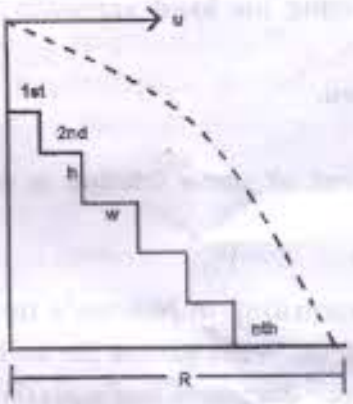
Q9. State the number of significant figures in the following measurements. (2)

(a) 0.009 m^2 (b) 13.75 (c) 648700. (d) 0.020800 m

Q10. Out of a pair of identical springs of spring constant 240 N/m, one is compressed by 10 cm and the other is stretched by 10 cm. What is the difference in the potential energies stored in the two springs? Explain. (2)

Q11. Calculate the dimensions of force and impulse taking velocity, density and frequency as basic quantities. (3)

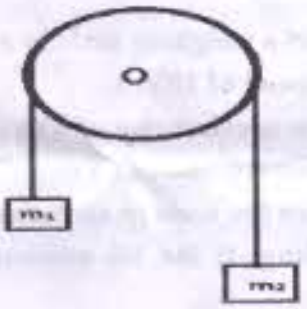
Q12. A ball rolls off the top of a stairway with a constant horizontal velocity u. If the steps are 'h' meter high and 'w' meter wide, show that the ball will just hit the edge of nth step if $n = \frac{2hu^2}{gw^2}$. (3)



Q13.(i) What do you mean by conservation of energy? (3)

(ii) An electric fan of mass 2 kg falls from the ceiling of lift moving down with uniform speed of 2 m/s. It hits the floor of the lift(length of the lift = 2 m) and does not rebound. How much heat will be produced by the impact?

Q14. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 ($m_2 > m_1$). Calculate the ratio of the masses if the acceleration of the system is g/8. (3)



Q15. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 second.

(i) What is its angular acceleration, assuming the acceleration to be uniform?

(ii) How many revolutions does the engine make during this time? (3)

Q16.Two particles of masses 100 g and 300 g at a given time have positions $2\hat{\imath} + 5\hat{\jmath} + 13\hat{k}$ and $-6\hat{\imath} + 4\hat{\jmath} - 2\hat{k}$ m respectively and velocities $10\hat{\imath} - 7\hat{\jmath} - 3\hat{k}$ and $7\hat{\imath} - 9\hat{\jmath} + 6\hat{k}$ m/s respectively. Determine the instantaneous position and velocity of centre of mass. (3)

Q17. Give reasons:

(a) Why a horse cannot pull a cart and run in empty space?

(b) In a tug-of-war, one team is slowly giving way to the other. Is work being done on the losing team? How about the winning team? (3)

Q18. A person is standing on a road with his open umbrella at 30^0 with the vertical to save himself from wetting. Then he throws his umbrella and starts running at 5 km/h. Now he

finds that rain drops are hitting his head vertically. Find the speed of rain drops with respect to:
(i) road (ii) the moving person. (3)

Q19. Prove that the coefficient of static friction is equal to the tangent of the angle of friction.

OR

When a horse pulls a cart, according to Newton's third law, the cart also pulls the horse with an equal and opposite force. What causes the motion of the horse, cart and the system as a whole? Explain with proper diagrams and equations involved. (3)

Q20.A gas bubble from an explosion under water oscillates with a time period T proportional to $P^a\rho^bE^c$ where P is the static pressure, ρ is the density of water and E is the total energy of the explosion. Find the values of a, b and c. (3)

Q21. Determine a unit vector which is perpendicular to both $\vec{A} = 2\hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{B} = \hat{\imath} - \hat{\jmath} + 2\hat{k}$. (3)

Q22. A man of 70 kg stands on a weighing scale in a lift which is moving
(a) upwards with a uniform speed of 10 m/s.
(b) downwards with a uniform acceleration of 5 m/s^2.
(c) upwards with a uniform acceleration of 5 m/s^2.
What would be the readings on the scale in each case?
(d) What would be the readings if the lift mechanism failed and it hurtled down freely under gravity? (3)

Q23. Mohinder Singh lived on the first floor flat of a four storey building at Tilak Nagar, Delhi. One day only Mohinder Singh and his aged grandmother were at home and other family members had gone out of station due to some family reason. Suddenly, Mohinder observed that there is dense smoke all around his flat. Soon he observed flames of fire coming from the neighboring flat in the same building. There was a lot of hue and cry in the building and people were panicked. Each one wanted to leave the building. There was a huge rush in the staircase. Mohinder could escape easily but he thought about how to save her aged and weak grandmother.
Mohinder got an idea. He used a turban cloth and suspended it downward from the balcony of his flat and asked a person standing on ground to hold the other end of turban cloth. Now he asked his grandmother to gently sit on the turban cloth. She hesitated but after persuation sat on the suspended piece of turban cloth. She comfortably reached the ground and the turban cloth remained intact.
(a) what value and qualities were exhibited by Mohinder Singh?

(b) What is the principle in your opinion which was employed by Mohinder Singh?
(c) What will be the tension in a cord/piece of cloth inclined at an angle 30^0 from horizontal when a person of mass 40 kg falls through it with an acceleration of 2 m/s^2? (4)

Q24. State parallelogram law of vector addition. Find analytically the magnitude and direction of the resultant of two vectors inclined at angle θ.

OR

Name the acceleration possessed by a body in uniform circular motion. What is its direction? Derive an expression for it. (5)

Q25. Derive an expression for the potential energy stored in a stretched spring.

A force $F = -\frac{k}{x^2}$ ($x \neq 0$) acts on a particle in x-direction. Find the work done by the force in displacing the particle from x = - a to x = 2a

OR

Give two points of difference between elastic and inelastic collisions.

A large mass 'M' moving with a velocity 'v' collides head-on with a very small mass 'm' at rest. If the collision is elastic, obtain an expression for the energy lost by the large mass M (Take $M + m \approx M$) (5)

Q26.(i) What is the need for Banking of roads.

(ii) Derive an expression for maximum speed a vehicle should have, to take a turn on a banked road. Hence deduce expression for angle of banking at which there is minimum wear and tear to the tyres of the vehicle.

OR

(i) Distinguish between static friction, limiting friction and kinetic friction. How do they vary with the applied force? Explain by a diagram.

(ii) Compute the acceleration of the block and trolley system as shown in the diagram. If the coefficient of kinetic friction between the trolley and the surface is 0.04, what is the tension in the string? [Take g = 10 m/s^2] (5)