NEELAKSHI

THE MOTHER'S INTERNATIONAL SCHOOL
FIRST TERMINAL EXAMINATION 2015 - 2016
CLASS - XI
SUBJECT: PHYSICS
Date – 15th Sept, 2015

TIME: 3 HOURS **M.M : 70**

General Instructions :

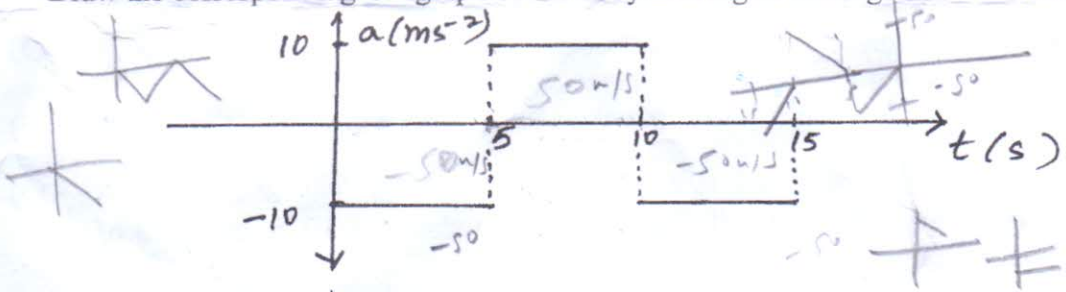
1. **All** questions are compulsory.
2. **Q.1** to **Q.5** are very short answer questions of **1** mark each.
3. **Q.6** to **Q.10** are short answer questions of **2** marks each.
4. **Q.11** to **Q.22** are long answer questions of **3** marks each.
5. **Q.23** is a value based question of **4** marks.
6. **Q.24** to **Q.26** are long answer questions of **5** marks each.

Q1. Define solid angle. What are its dimensions? **(1)**

Q2. A rocket moving in free space is giving out exhaust gases in the opposite direction. What happens to the centre of mass of the system ? Why? **(1)**

Q3. A body is projected at angle of 45^0 with initial kinetic energy E. What is the kinetic energy at the highest point? **(1)**

Q4. Draw the corresponding V-t.graph of the body moving in the negative x direction. **(1)**



Q5. The moments of inertia of two rotating bodies A and B are I_A and I_B respectively ($I_A > I_B$). If their angular momenta are equal, which body has a greater kinetic energy? **(1)**

Q6. The density of a material is 8g/cc. Find its density in a system of units with 20g and 5m as the base units of mass and length respectively. **(2)**

Q7. A player throws a ball of mass 10g vertically upwards at $30ms^{-1}$. Find the magnitude and direction of force acting on it. **(2)**

(a) After 2 seconds
(b) At the highest point
(c) After 5 seconds
(d) Will the above answers change if the player is standing in a balloon ascending at $5ms^{-1}$. (Ignore air resistance)

Q8. A ball moving at $10ms^{-1}$ hits a stationary ball of same mass. After collision each ball makes 60^0 with the original line of motion. Find the speeds of the two balls after collision. **(2)**

Q9. Draw the force-diagram of a body of mass 'm' moving on a road banked at an angle **θ**. The coefficient of friction between the tyres and the road is **μ**. **(2)**

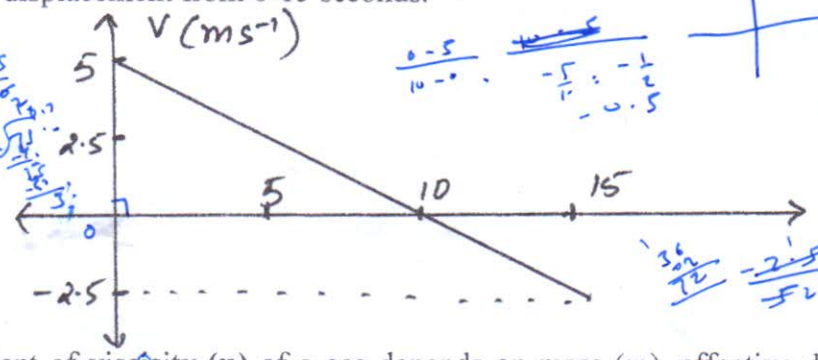
Q10. Find the moment of inertia of a uniform circular disc of mass M and radius R, about a tangent in its own plane. **(2)**

Q11. The V-t graph of a body is shown **(3)**

(a) Explain what happens at t = 10s.

(b) Draw the a-t graph.

(c) Find the displacement from 0-15 seconds.



Q12. The coefficient of viscosity (η) of a gas depends on mass (m), effective diameter (d) and mean speed (v) of gas molecules. Using dimensional analysis, find the relation between them. (S.I.unit of η is Pascal-second). **(3)**

Q13. A car A is travelling on a straight road at 60kmh^{-1}, It is followed by car B moving at 70 kmh^{-1}. When the distance between them is 2.5km, car B decelerates at 20 kmh^{-2}. After what time do the two cars meet? How much distance does B have to travel to catch up with A ? **(3)**

Q14. Explain how the distance of a nearby astronomical object can be measured from the earth using an indirect method. **(3)**

Q15. Find the resultant of $\vec{F_1} = 3\sqrt{2}$ N north-east, $\vec{F_2} = 6\sqrt{2}$ N south east $\vec{F_3} = 2$N, 30^0 north of west. **(3)**

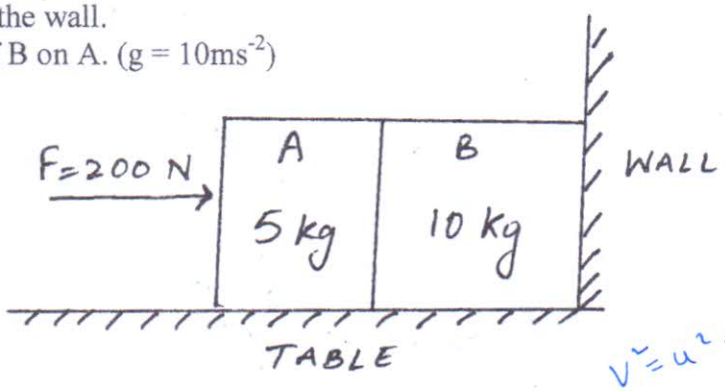
Q16. Derive the expression for the external force required to make a body move a circular path. **(3)**

Q17. A ball of mass 0.15kg hits a vertical wall and is deflected by 45^0 without changing its speed (54kmh^{-1}). Find the impulse imparted to the ball. Draw a diagram showing the components of linear momentum.(Cos 22.5^0 = 0.92) **(3)**

Q18. If the coefficient of friction between the bodies and the table is 0.15, find **(3)**

(a) the reaction of the wall.

(b) The reaction of B on A. (g = 10ms^{-2})

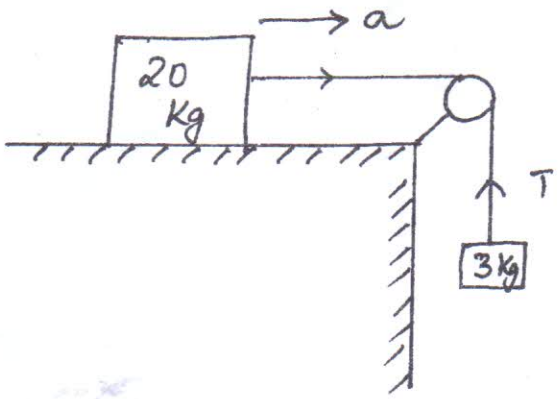


Q19. Obtain the third equation of rotational motion using calculus. **(3)**

Q20. A body starts from the origin at t = 0 with a velocity of 10$\hat{j}$ ms^{-1} and moves in the x – y plane with acceleration (8 $\hat{i}$ + 2$\hat{j}$) ms^{-2}. At what time is the y coordinate 56m. What is the velocity at this time? **(3)**

Q21. State the law of conservation of angular momentum. Explain the law with the help of two examples. **(3)**

2. The system starts from rest. If the 3kg body covers a distance of 50m in 10 seconds. Find the coefficient of friction between the 20kg block and the table. ($g = 10ms^{-2}$) **(3)**



Q23. (a) A worker in a construction site was pushing a wheelbarrow full of heavy stones. He had to apply a lot of effort while pushing it. An engineer working at the site explained to him that by pulling the wheelbarrow, he would have to apply less effort. The worker did as instructed and thus was able to finish his job easily.

(i) Mention two qualities of the engineer.
(ii) Why is pulling a wheelbarrow easier than pushing?
(iii) The sum of two forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is reversed the resultant is $\vec{S}$. Find $R^2 + S^2$.

(1 + 1 + 2= 4)

Q24. (a) Derive the expression for potential energy of a compressed horizontal spring. Draw the graph of applied force and displacement from the mean for the spring. What does the area under the graph represent?

(b) A bullet of mass 0.012kg moving at $70ms^{-1}$ horizontally, strikes a block of mass 0.4kg suspended from the ceiling. The bullet comes to rest instantly inside the block and the system rises to a height 'h'. Find 'h' and the heat produced in the block ($g = 10ms^{-2}$)

($2\frac{1}{2} + 2\frac{1}{2}$ =5)

Q25. (a) A projeclile is fired at an angle 'α' to the horizontal with intial velocity 'u'. Find mathematically the nature of its path. Derive relations for horizontal range and maximum range.

(b) Two balls are projected at θ and $(90^0 - \theta)$ from the vertical with the same speed. The first one reaches 60m higher than the second. Find their initial speeds if the second ball reaches a height of 20m. ($g = 10ms^{-2}$)

(3 + 2 = 5)

Q26. (a) Derive the rotational analogue of $\vec{F} = m\vec{a}$ from the expression $\vec{L} = \vec{r} \times \vec{p}$.

(b) An iron rod of weight 50kgf has a 10kgf weight attached to one end. It Balances itself at 6m from the same end. Find the length of the rod.

($2\frac{1}{2} + 2\frac{1}{2}$ =5)

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