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CUMULATIVE EXAMINATION - 2014-15

SUBJECT - XI

CLASS - PHYSICS

Time : 3 Hrs.

M.M. 70

General Instructions:

All questions are compulsory.

There is no overall choice. However there is an internal choice has been provided in one question of two marks, one question of three marks and all three questions of 5 marks each.

You have to attempt only one of the choices in such questions.

- (i) Questions 1 to 5 each one mark. (VSA)
- (ii) Questions 6 to 10 each two mark. (SA-I)
- (iii) Questions 11 to 22 each three mark. (SA-II)
- (iv) Questions 23 is value based question and carry four marks. (VBQ)
- (v) Questions 24 to 26 each five mark. (LA)

[P.T.O.]

- Q1. Write the dimension and SI unit of linear momentum. 1
- Q2. What does the slope of velocity-time graph represent? 1
- Q3. Give the magnitude and direction of net force acting on
- (a) A drop of rain falling down with constant speed.
 - (b) A cork of mass 10 g floating on water. 1
- Q4. Name the physical quantity which is expressed as 'the dot product of force and velocity'. Is it scalar or a vector quantity? 1
- Q5. Is it necessary that the centre of mass of a body should always lie inside the body? Justify your answer. 1
- Q6. In which of the following examples of motion can the body be considered approximately a point object:
- (a) A railway carriage moving without jerks between two stations.
 - (b) A monkey sitting on the top of a man cycling smoothly on a circular track.
 - (c) A spinning cricket ball that turns sharply on hitting the ground, and
 - (d) Tumbling beaker that has slipped off the edge of a table? 2
- Q7. (a) Define relative error. 2
- (b) The error in the measurement of radius of sphere is

[P.T.O.]

2%. What would be the error in the volume of the sphere? 2

— Q8. State the law of conservation of linear momentum. Derive it from the Newton's second law of motion.

OR

Define coefficient of limiting friction. A body slides down an inclined plane having friction. Indicate the directions of frictional force and the reaction of the plane on the body.

2

Q9. A body of mass m is raised to a height h from the surface of the earth where the acceleration due to gravity on the surface of the earth. Prove that the loss in weight due to variation of g is approximately $2mgh/R$. Where R is the radius of earth and $h \ll R$ 2

Q10. The escape velocity on earth is 11.2 km/s . What will be its value on a planet having double the radius and eight times the mass of earth? 2

Q11. Explain why:

- (a) It is easier to pull a lawn mower than to push it.
- (b) ✓ A cricketer moves his hands backwards while holding a catch.
- (c) The outer rail of a curved railway track is generally raised over the inner. 3

[P.T.O.]

Q12. The displacement (in metre) of a particle moving along x-axis is given by $x = 18t + 5t^2$.

Calculate :

- (a) The instantaneous velocity at $t = 2s$.
- (b) Average velocity between $t = 2s$ and $t = 3s$.
- (c) Instantaneous acceleration.

3

Q13. Rain is falling vertically with a speed of 30 ms^{-1} . A woman rides a bicycle with a speed of 10 ms^{-1} in north to south direction. What is the relative velocity of rain with respect to the woman? What is the direction in which she should hold her umbrella to protect herself?

3

Q14. The velocity 'v' of water waves depends on the wavelength ' λ ', density of water ' ρ ' and the acceleration due to gravity 'g'. Deduce by method of dimensions the relationship between these quantities.

3

Q15. A man weighs 70 kg. He stands on a weighing machine 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 readings on the scale in each case?

3

[P.T.O.]

Q16. Define angle of repose. Deduce its relation with coefficient of friction. 3

Q17. State and prove work –energy theorem. 3

Q18. Springs A and B are identical except that A is stiffer than B, i.e. force constant $k_A > k_B$. In which spring is more work expended if they are stretched by the same amount. 3

Q19. (i) A child stands at the centre of a turn table with his two arms out stretched. The turn table is set rotating with an angular speed of 40 rpm. How much is the angular speed of the child change if he folds his hands back and thereby reduces his moment of inertia to $\frac{2}{3}$ times the initial value? Assume that the turntable rotates without friction.

(ii) Show that the child's new kinetic energy of rotation is more than the initial kinetic energy of rotation.

OR

State the law of conservation of angular momentum. Find the torque of a force $7\hat{i} - 3\hat{j} - 5\hat{k}$ about the origin which acts on a particle whose position vector is $\hat{i} + \hat{j} - \hat{k}$ 3

Q20. What is torque? Give its unit, show that it is equal to the product of force and the perpendicular distance of its line of action from the axis of rotation. 3

[P.T.O.]

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