Name Dakch Class & Section _____ Roll No. _____

BVN

FIRST TERMINAL EXAMINATION—2016-17

CLASS-XI

SUBJECT–PHYSICS

Time : 3 Hours **M.M. : 70**

Please check the total marks

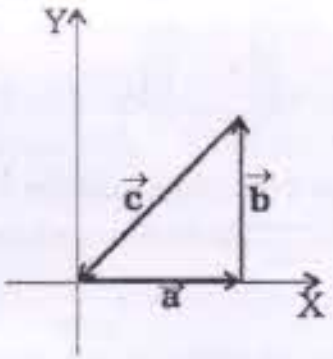
General Instructions :

1. *All questions are compulsory. There are 26 questions in all.*
2. *This question paper has five sections : Section A, Section B, Section C, Section D and Section E.*
3. *Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.*
4. *There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*

Section-A

1. Why parallax method for determining distance of stars limited to about 100 ly ? (1)

2. Write the relation between vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ shown in the figure below : (1)



3. A force F is applied to two objects of masses m_1 and m_2 ($m_1 < m_2$) respectively. For which object will the rate of change of momentum be greater ? (1)

4. Plot a graph to show how the spring constant of a spring varies with its length. (1)

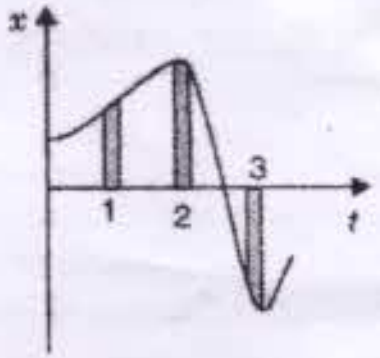
5. For a given mass and size, moment of inertia of a solid disc is smaller than that of a ring. Why ? (1)

Section-B

6. A Vernier caliper has 20 Vernier scale divisions and one main scale division reads 0.1 cm. What is its Vernier constant ?

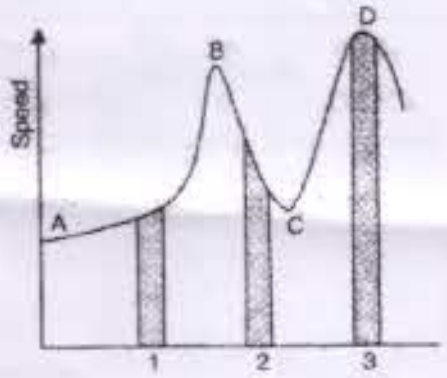
   For measuring the height of a cylinder, main scale lies between 7.2 cm and 7.3 cm and 15th Vernier division coincides with some division of main scale. Find the height of the cylinder in cm. (2)

7. X-t- plot of a particle in one dimensional motion is as shown. Three different time intervals are marked. In which interval is average speed maximum, and in which interval is it minimum ? Give the signs of average velocity for each interval. (2)



OR

Speed time graph of a body in motion along a constant direction is shown. Three equal time intervals are marked. (i) In which interval is the average acceleration has largest magnitude ? (ii) Choosing positive direction as the direction of motion, give sign of 'a' in each interval. (2)



8. A projectile is projected with speed 'u' at an angle θ with the vertical. What is its speed at (i) the highest point in its trajectory and (ii) the moment when it hits the ground ? Justify your answer. (2)

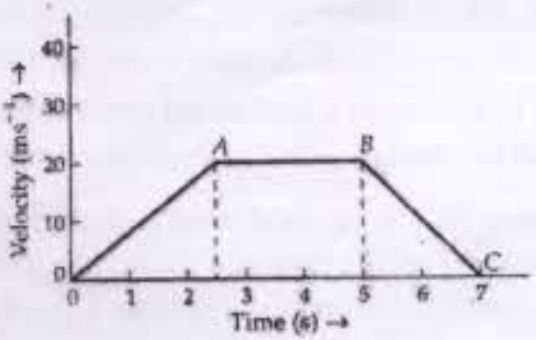
9. A girl riding a bicycle along a straight road with a speed of 5 m/s throws a stone of mass 0.5 kg which has a speed of 15 m/s w.r.t. the ground along the direction of motion. The mass of the cycle and the girl is 50 kg. Does the speed of the bicycle change after the stone is thrown ? What is the change in speed, if so ? (2)

10. Explain how a boy sitting on a revolving chair, which is spinning, can increase or decrease his speed of rotation. (2)

Section-C

11. Derive by the method of dimensions an expression for the volume of a liquid flowing per unit time through a narrow pipe. Rate of flow of liquid depends on coefficient of viscosity (η), the radius of the tube (r) and pressure gradient (P/L). (3)

12. The velocity time graph of a body is given. Plot acceleration time graph of the body to scale. (3)



13. A ball is dropped from a bridge 125 m above a river. After the ball has been falling for 2 s, a second ball is thrown straight down after it. What must be its initial velocity so that both hit the water at the same time ? Take $g = 10\ m/s^2$. (3)

14. A particle moves in an XY plane in such a way that its X and Y coordinates vary with time as $X = t^3 - 32t$ and $Y = 5t^2 + 12$. Here X and Y are in units of metres and time is in seconds. Find the velocity and acceleration of the particle, when $t = 2$ seconds. (3)

15. Give reason for the following :

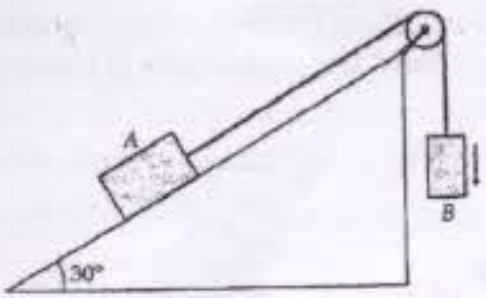
(i) Carpets are cleaned by hitting them with rods

(ii) Vehicles are fitted with shock absorbers

(iii) Spikes and studs are used in the shoes of athletes. (3)

16. State the principle of conservation of linear momentum for a system of interacting particles. Using this law, derive suitable mathematical relation to explain why a rifle must be held tight to the shoulder while firing. (3)

17. Two blocks A and B each of mass 14 kg are connected by an inextensible string passing over a light frictionless pulley. Block A is free to slide on a surface inclined at an angle of 30° with the horizontal whereas block B hangs freely and moves downward with constant velocity. What is (i) the magnitude of frictional force and (ii) the coefficient of kinetic friction ? $g = 10\ m/s^2$. (3)



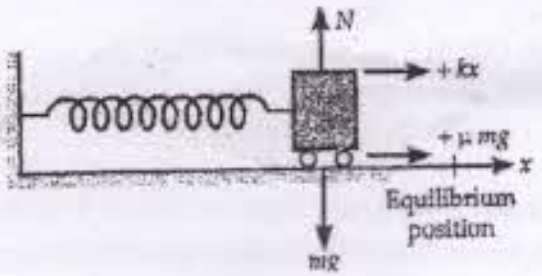
18. (a) The total work done by a body when it is moved over a closed path is zero. What is the nature of force experienced by the body ? Mention two other important properties of that type of force.

(b) A body kept at height 'h' is dropped. Plot a graph showing the variation of kinetic energy, potential energy and total mechanical energy of the body with height, assuming no loss of energy due to friction. (1½+1½=3)

19. (a) Two springs A and B are identical except that A is stiffer than B, i.e. force constant of A > force constant of B. In which spring is more work done if they are stretched by same force ?

(b) A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force of $-K/r^2$, where k is constant. What is the total energy of the system ?(1½+1½=3)

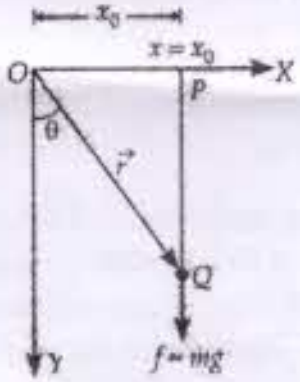
20. A car of mass 1000 kg moving on a horizontal road with a speed of 18 km/h collides with a horizontally mounted spring of spring constant 6250 N/m. If the coefficient of friction is 0.5, calculate the maximum compression of the spring. Take $g = 10 m/s^2$. (3)



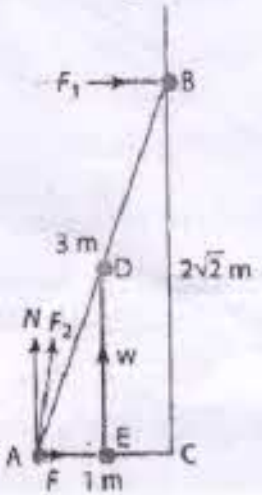
21. A particle of mass m is released from point P at $x = x_0$ on the X axis from origin O and falls vertically along the Y axis, as shown in the figure.

(a) Find the torque acting on the particle at the instant when it is at point Q w.r.t. O. Find the direction of torque.

(b) Find the angular momentum of the particle about O at the same instant. (3)



22. A 3 m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall as shown. Find the magnitude of the reaction forces of the wall and the floor. (3)



OR

From a uniform disc of radius R, a circular hole of radius R/2 is cut out. The centre of the hole is at R/2 from the centre of original disc. Locate the centre of mass of the resulting flat body. (3)

Section-D

23. Ravi was moving towards neighbourhood market one day. He observed a horrendous head on collision between two cars coming from opposite direction. Both the drivers were hurt. Ravi joined the other people nearby in rescuing the drivers and helping them to the ambulance, which was summoned by some gentleman. Normalcy was restored when police came and towed the cars away. Later that day Ravi realized that the cause of the accident was no divider on the road and poor driving sense of both the drivers. He decided to do something so that this is not repeated in future. He talked to his father and other elders of the area and convinced them to write to various agencies, so that a divider could be constructed on the road.

(i) Write two moral values displayed by Ravi during ths incident.

(ii) What happened to the linear momentum and kinetic energies of the two cars after collision ? Justify your answers. (2+2=4)

Section-E

24. (a) A stone is thrown vertically upwards and then it returns to the thrower. Is it a projectile ? Justify.

(b) Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum horizontal range.

(c) A projectile of mass m is thrown with velocity u from the ground with an angle of 45° with the horizontal. What is the magnitude of change in momentum between leaving and arriving at the ground ? (1+2+2=5)

OR

(a) A swimmer who can swim in still water at speed v_s wants to cross the river flowing at speed v_w. In what direction should he swim to cross the river in shortest possible time? Explain using suitable mathematical expression and find the expression for time taken to cross the river and his resultant displacement.

(b) If he now wishes to reach exactly the opposite bank, covering shortest distance, along what direction must he strike ? What is its resultant velocity ? (3+2=5)

25. (a) What do you mean by banking of roads ? Why do we need to bank roads ?

(b) A vehicle of mass m is moving in a circular path of radius 'r' which is banked by an angle θ. Draw a free body diagram of the vehicle showing all the forces acting on it. Write an expression for (i) the maximum safe speed with which the vehicle can take a turn on this road, if the coefficient of friction is μ and (ii) the angle of banking. (2½+2½=5)

OR

(a) What do you mean by angle of repose ? Show that it is equal to angle of friction.

(b) Draw free body diagram of a lawn mower when it is (i) pushed and (ii) pulled. Using the diagrams, explain which of the two is easier ? (3+2=5)

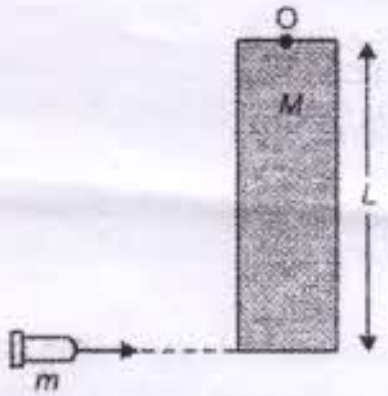
26. (a) What do you mean by a couple ? What is its effect on a rigid body ? Show that the moment of couple is same irrespective of the point of rotation of the body.

(b) A stick of length L has half the portion made of wood and the other half of steel. It is pivoted at the wooden end and a force is applied at the steel end at right angles to its length. Next, it is pivoted at the steel end and the same force is applied at the wooden end. In which case is the angular acceleration more and why ? (3+2=5)

OR

(a) Obtain an expression for rotational kinetic energy of a rigid body rotating with constant angular velocity 'ω'.

(b) A rod of length L and mass M is hinged at point O. A small bullet of mass m hits the rod with velocity 'v' as shown. The bullet gets embedded in the rod. Find the angular velocity of the system just after the impact. (2+3=5)



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