SUBJECT - PHYSICS

CLASS - XI

Time : 3:00 Hrs.   **M.M. 70 MARKS**

GENEREL INSTRUCTIONS:

1. All questions are compulsory.

2. There are 26 questions in all. Questions 1 to 5 carry 1 mark each, questions 6 to 10 carry 2 marks each, questions11 to 22 carry 3 marks each ,Q.No 23 carries 4 marks ,Q.Nos24 to 26 carry 5 marks each .

3. There is no overall choice. However, there is an internal choice in one question of 2 marks and one question of 3 marks and all three questions of five marks. you have to attempt only one of the given choices in such questions.

4. Use of calculator is not permitted.

5. Draw neat &labelled diagrams with pencil where –ever required.

6. You may use the following physical constants wherever necessary:

    Boltzmann constant $K_B = 1.38 \times 10^{-23} J/K$

    Acceleration due to gravity $g = 10 \ m/s^2$

    Avogadro's Number $N_A = 6.023 \times 10^{23}/mole$

    Density of mercury $\rho = 13.6 \times 10^3 kg / m^3$

    Velocity of sound $v = 340 m/s$

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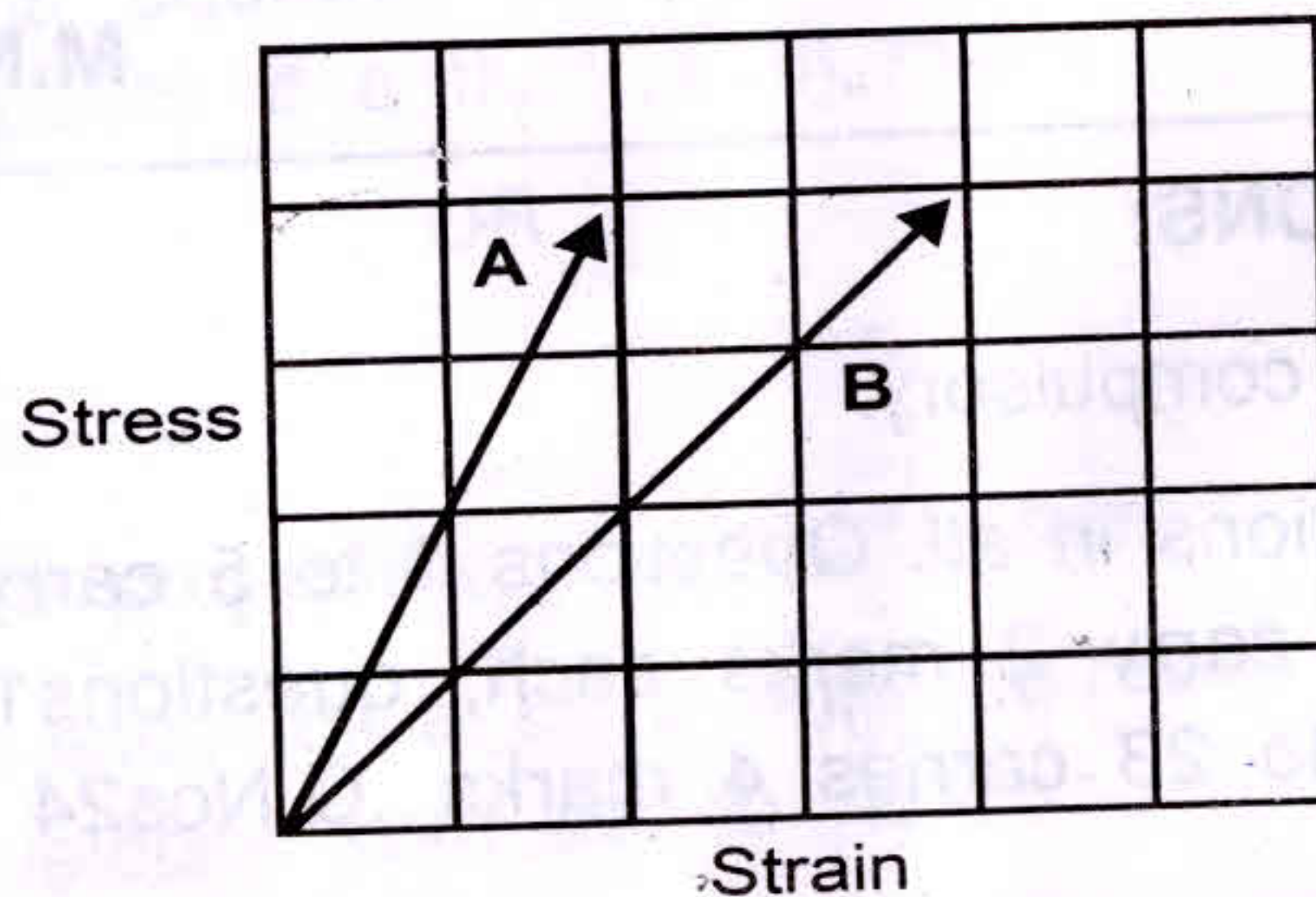
[P.T.O.]

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1. Name the unit used to measure size of a nucleus of an atom . Also write its equivalence in SI system   1

2. What is the angle between two non- zero vectors if

$$|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$$

1

3. Stress - strain graph of two metals A & B are given below. Which one of the two is more elastic and why   1

4. "To keep a piece of paper horizontal in air, you should blow over, not under it." Explain.   1

5. A wave travelling along a string is given by

$$Y(x,t) = 0.005 \sin(80 \, x - 3t)$$

Where the numerical values are in SI units. Symbols have their usual meanings Calculate the velocity of the wave.   1

6. Kinetic energy is given by the following formulae:

(i)   K.E.$= 3/16 mv^2$

(ii)   K.E.$= 1/2 \, mv^2 + ma$

Select the correct formula on the basis of dimensional arguments:2

7. Prove the following statement" for elevations which exceeds or fall short of 45° by equal angles, the ranges are equal".

OR

A man of mass 70kg stands on a weighing scale in a lift which is:

(a) Moving down with the uniform acceleration of 5 m/s^2

(b) Moving upward with the uniform speed of 10 m/s

What would be the reading on the scale in each case   2

8. Name the Physical quantity equivalent to force in rotational motion. How is it related to force and give its unit?   2

9. State the no. of degrees of freedom possessed by a mono atomic molecule in space. Also give the expression for total energy possessed by it:-

(i) At given temperature, (ii)Calculate total energy of the atom at 300° K.   2

10. Draw temperature -volume graph for carbon dioxide gas near to room temperature

(a) As expected by Charles Law

(b) As observed experimentally   2

11. A ball is thrown vertically upwards with a velocity of 20m/s from the top of a building of height 40 meter from the ground.

(a) How high the ball reaches

(b) How long will it take to reach the ground

(c) The speed by which it strikes the ground   3

**OR**

A cricket ball is thrown at a speed of 28 m/s in a direction 30° above the horizontal Calculate :

[P.T.O.]

(a)   The maximum height attained

(b)   The time taken by the ball to the same level of projection

(c)   The horizontal distance from the point of projection to the point where the ball returns to the same level .   3

12.   A block of wood of mass 3 kg .is resting on the surface of a rough inclined surface, inclined at an angle 30° as shown in the figure:
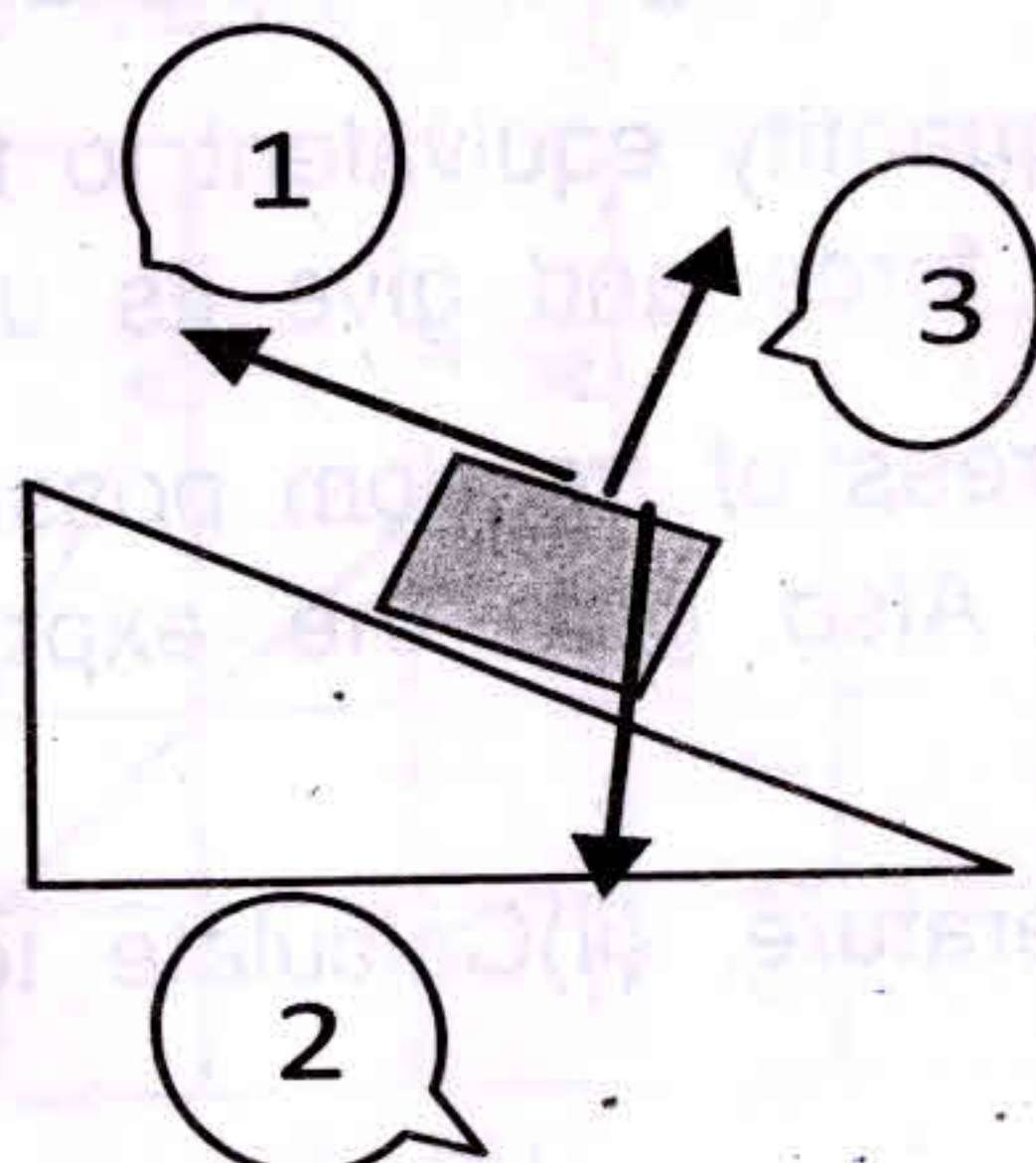
(a)   Name the forces (1,2,3)   3

(b)   If the coefficient of static friction is 0.2 , calculate the value of all the three forces

13.   Draw the following graphs for motion of an object under free fall

(a)   Position -time

(b)   velocity - time

(c)   Acceleration – time   3

14.   A Man standing near the edge of a cliff,500 meters above the ground throws a stone horizontallywith a speed of 15m/s .Calculate the time taken and the speed with which it hits the ground.   3

15.   Calculate the work done by the force, when the displacement is from x=4 m to x=10m in the following graph   3

[P.T.O.]

Extension (Displacement)
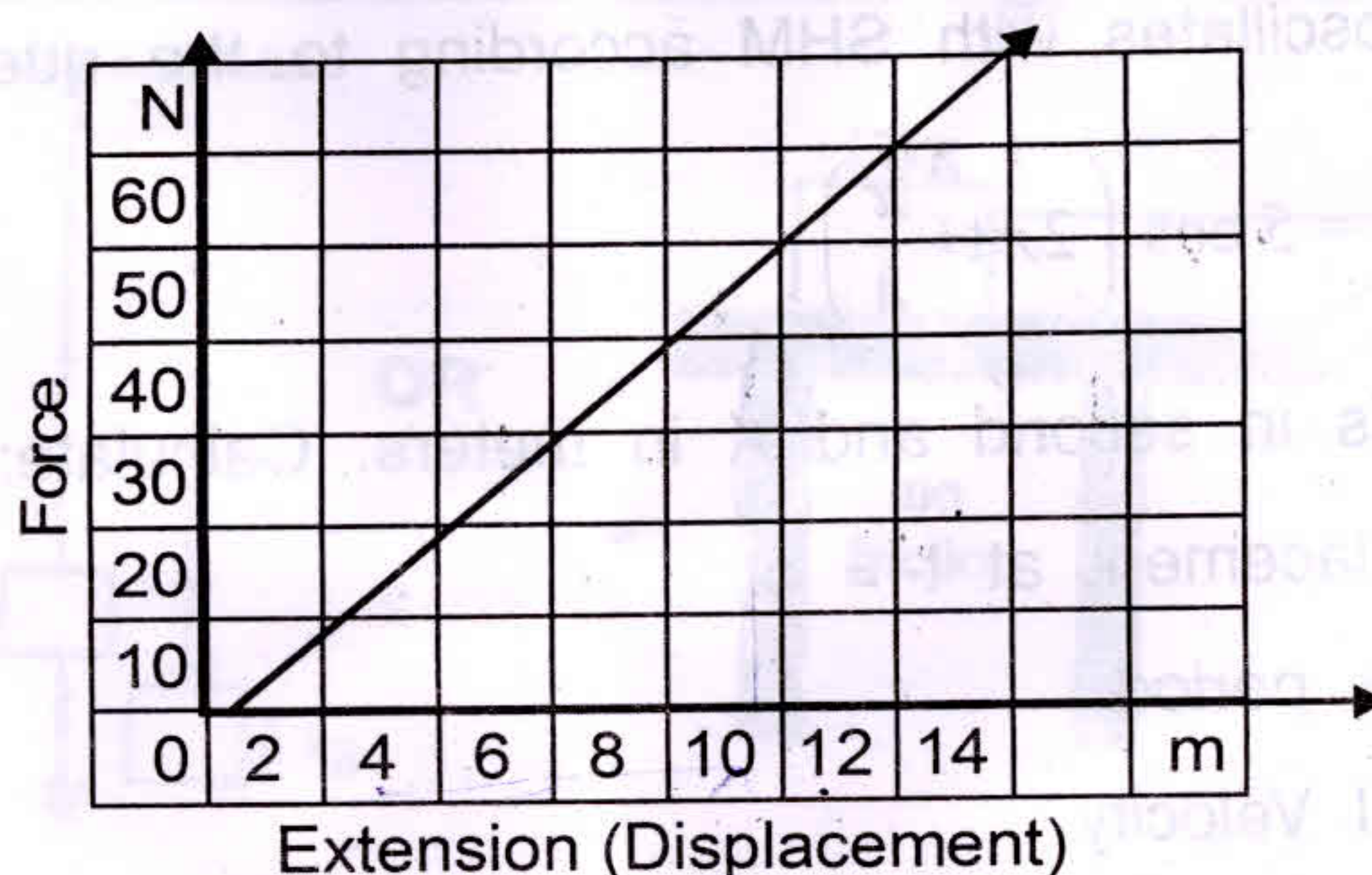
16. State parallel axis theorem for moment of inertia. calculate moment of inertia of a ring of mass 'M' and radius 'R' about its tangent in the plane of the ring using this theorem, if the moment of inertia about a diameter is ½ MR².   3

17. Pressure of a gas in a closed cylinder is expressed in the following way :

$$P = P_a + h\rho g$$

    (i)   Identify the terms for :

        (a)   Absolute pressure of the gas

        (b)   Gauge pressure of the gas

    (ii)   Convert a pressure of 76 cm height of mercury to Pascals   3

18. State Stoke's law and derive an expression for it.   3

19. (a)   Give Kelvin –Planck statement of second law of Thermody namics .

    (b)   Draw energy flow diagram for an engine.

    (c)   Write an expression for coefficient of efficiency for an engine.   3

[P.T.O.]

20. A body oscillates with SHM according to the question :

$$X(t) = 5 \cos \left(2\pi t + \frac{\pi}{4} \right)$$

Where t is in second and X in meters. Calculate:

(a) Displacement at t = o.

(b) Time period

(c) Initial Velocity   3

21. (a) State any two conditions for formation of standing waves.

(b) A train is passing through a station with velocity 80 m /s by blowing horn at a frequency 512 Hz. Calculate the frequency of sound heard by a person standing on the platform

(i) when the train is approaching

(ii) when the train is receding.   3

22. A Spring balance has a scale that reads from 0 to 50kg. The length of the scale is 20 cm. When a body is suspended from this balance and released, oscillates with a period of 0.6 s . What is the weight of the body?   3

23. Suraj, a Student of class XI was cycling near his Vidyalaya in a late evening. He saw lights on in many class rooms of his Vidyalaya. He reached the Vidyalayagate and requested the guard to switch off these lights since no one is working in any of these rooms. He guarded the gate till the guard came back.

(a) What are the values showed by Suraj in the above story?

(b) What is the commercial unit of electric energy?

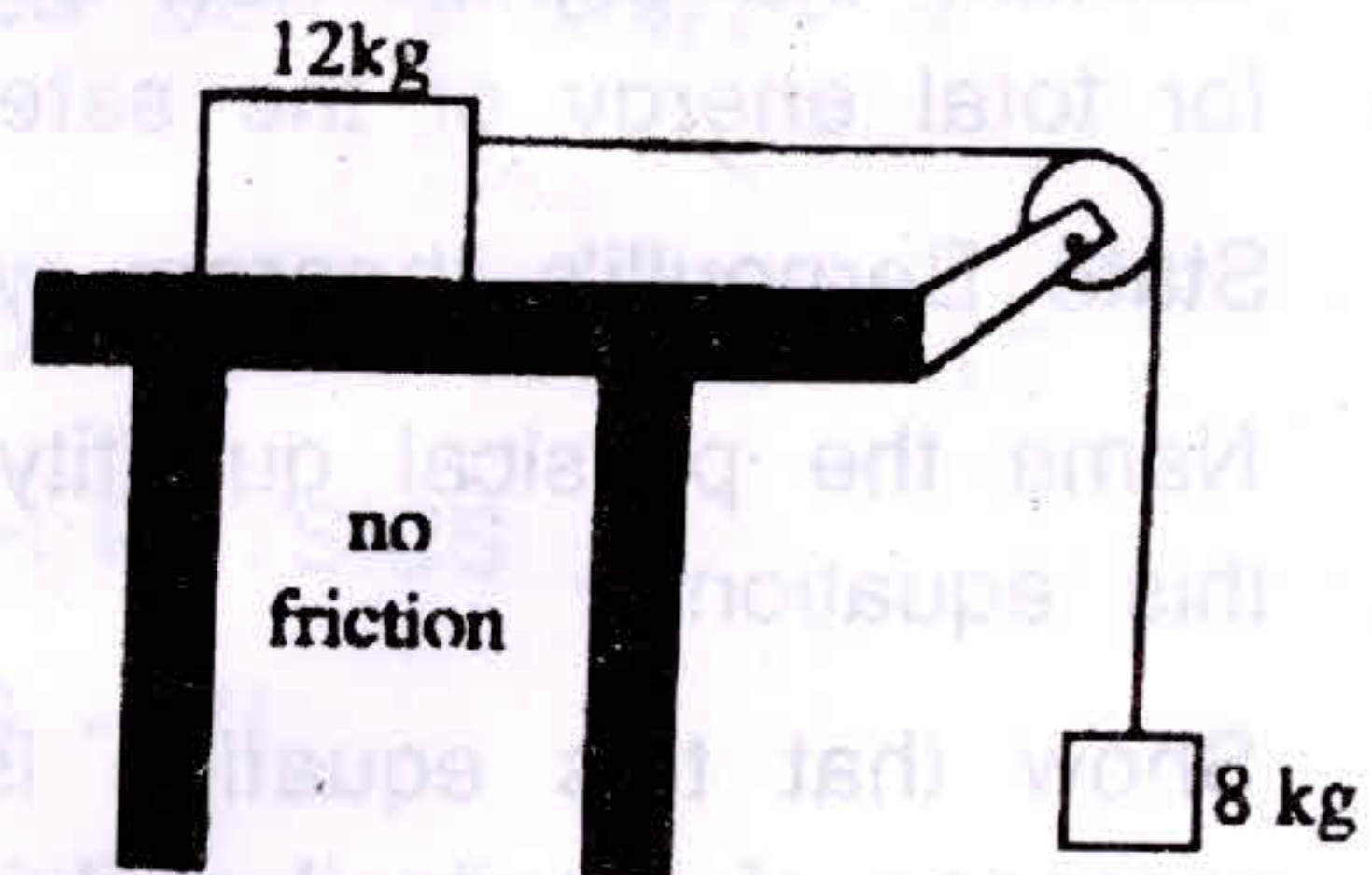(c) Give its equivalence in Joules.   4

[P.T.O.]

24.

OR

no friction

(i)   (ii)
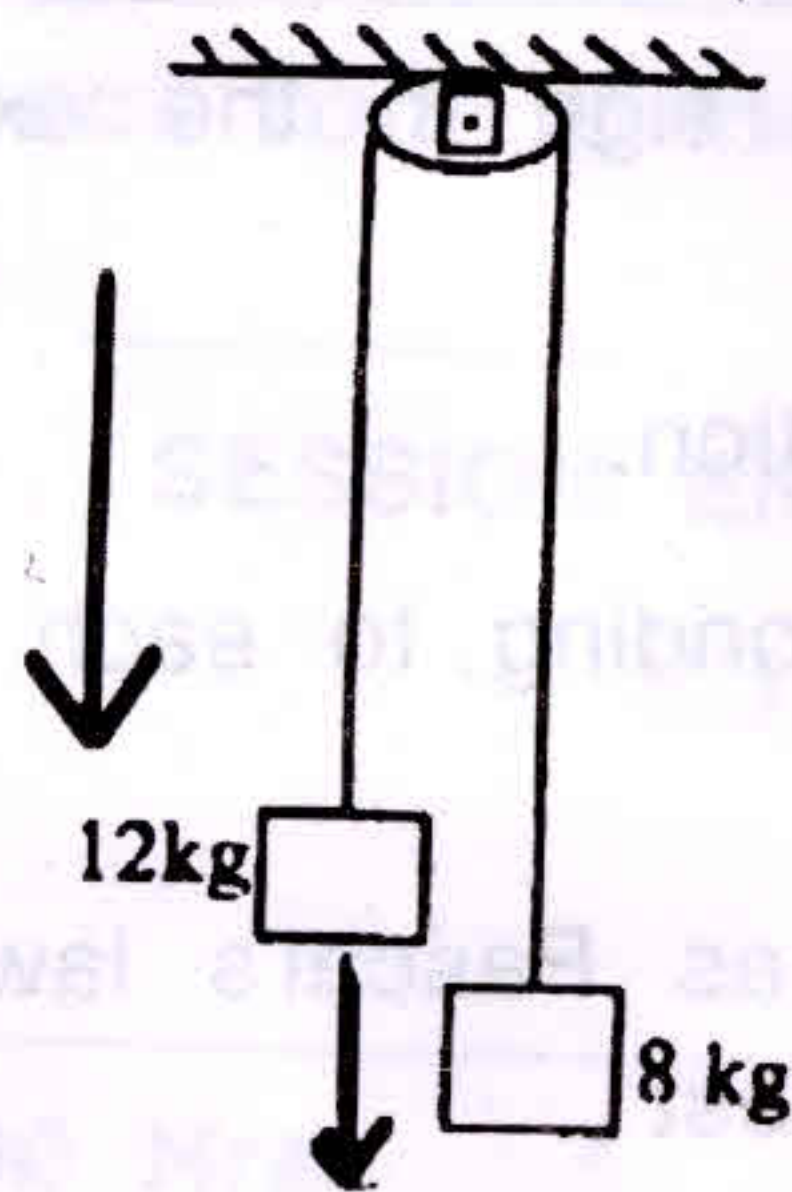
(a) Indicate using vector forces acting on the 12kg & 8 kg masses in (i) OR (ii)

(b) Write the equations for the net forces action on 12 kg & 8 kg masses selected in(a)

(c) Calculate the acceleration of the masses and tension on the string

1,2,2

25 (a) Give two necessary conditions for elastic collision

(b) If a mass m_1 moving with uniform velocity u_1 collides head on with another mass m_2 at rest and continue to move in one dimension only, derive formula for the final velocities.

(c) Fine the final velocities in above case if $m_1 : m_2 = 1:3$

5

OR

(a) what is the work done by earth's gravitational force in keeping anartificial satellite orbiting at a height of 36500 km above the surface of earth   ?

(b) Derive an expression for total energy of satellite orbiting very close to earth.

(c)   Explain the significance of negative sign in the expression for total energy of the satellite.   5

26.   (a)   State Bernoulli's theorem with equation.

(b)   Name the physical quantity corresponding to each term of this equation.

(c)   Show that this equation is same as Pascal's law in the presence of gravity if a fluid is at rest .   5

OR

(a)   Define stream line.

(b)   Write any two properties of stream lines.

(c)   Draw stream lines for a clock wise spinning sphere moving with certain velocity from left to right.

(d)   State and derive equation of continuity.   5