



# PHYSICS

## BOOKS - S CHAND PHYSICS (ENGLISH)

### SELF ASSESSMENT PAPER 02

#### Section A Choose The Correct Alternative

1. The component of a vector  $r$  along X-axis will have maximum value if :

A.  $r$  is along positive Y-axis

B.  $r$  is along positive X-axis

C.  $r$  makes an angle of  $45^\circ$  with the Y-axis

D.  $r$  is along negative Y-axis

**Answer:**



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2. A particle moves in a circle of radius 25 cm at 2 revolution per second. The acceleration of the particle in meter per second<sup>2</sup> is

A.  $\pi^2$

B.  $8\pi^2$

C.  $4\pi^2$

D.  $2\pi^2$

**Answer:**



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**3.** A force of 100 N is applied horizontally on a block of mass 10 kg placed on a horizontal floor of coefficient of friction 0.5, The

acceleration of the block is

(take  $g = 10\text{ms}^{-2}$ )

A. Zero

B.  $5.2\text{ms}^{-2}$

C.  $10\text{ms}^{-2}$

D.  $5\text{ms}^{-2}$

**Answer:**



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4. A satellite is orbiting very close to earth's surface (earth's radius  $R$ ). Its orbital speed is :

A.  $\sqrt{R, g}$

B.  $\sqrt{2R_e g}$

C.  $\sqrt{R_e g / 2}$

D.  $(R_e g)^2$

**Answer:**



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5. The number of degrees of freedom of a rigid diatomic molecule is :

A. 2

B. 5

C. 4

D. 6

**Answer:**



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## Section A Answer The Following

1. Is the measure of an angle dependent upon the unit of length ?



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2. Can variables be dimensionless ?



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**3.** Both the magnitude and the direction of the acceleration of a body are constant. Will the path of body be necessarily a straight line ?



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**4.** Is centre of mass always a reality ?



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5. Compute the fractional change in volume of glass slab when subjected to a hydraulic pressure of 10 atm. (1 atm =  $1.013 \times 10^5$  Pa, Bulk modulus of glass =  $37 \times 10^9$  pa)



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6. When a drop of water falls on a very hot iron, it takes quite long to evaporate. Why ?



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7. Write the expressions for velocity and acceleration of a particle executing simple harmonic motion in terms of its displacement.



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## Section B Answer The Following

1. Static-friction is a self-adjusting force.

Comment.



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2. What is meant by weightlessness ?



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3. Prove that

$$\vec{A} = 4\hat{i} + 3\hat{j} + \hat{k} \text{ and } \vec{B} = 12\hat{i} + 9\hat{j} + 3\hat{k}$$

are parallel to each other.



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4. The moment of inertia of a flywheel is  $4 \text{ kg-m}^2$ . What angular acceleration will be produced in it by applying a torque of  $10 \text{ N-m}$  on it ?



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5. The moments of inertia of two rotating bodies A and B are  $I_A$  and  $I_B (I_B > I_A)$  and their angular momentum are equal. Which one has a greater kinetic energy ?





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6. A body of mass 100 kg falls on the earth from infinity. What will be its velocity on reaching the earth ? Radius of the earth is 6400 km and  $g = 9.8 \text{ ms}^{-2}$  . Air friction is negligible.



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7. Both transverse and longitudinal mechanical waves can propagate through a solid, but only

longitudinal wave can propagate through a gas. Explain.



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8. Water rises in a glass capillary tube, but descends if the bore of the capillary tube is coated with paraffin wax. Why ?



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9. The internal energy of a compressed gas is less than that of a rarefied gas at the same temperature. Why ?



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10. A gas expands from 75 liter to 125 liter at a constant pressure of 4 atmosphere. If one atmospheric pressure is  $1.0 \times 10^5 \text{ Pa} (\text{Nm}^{-2})$ , calculate the work done by the gas during this expansion.





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**11.** Thermal conductivity of air is less than that of felt but felt is a better heat insulator in comparison to air. Why ?



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**12.** One mole of an ideal gas is heated isobarically from the freezing point to the boiling point of water, each under normal pressure. Find out the work done by the gas



and the change in its internal energy. The amount of heat involved is 1 kJ. Given gas constant  $R = 8.3 \text{ J/mol K}$ .



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**13.** In summer the sound of a siren is heard louder in the night than in the day to a person on earth. Why ?



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## Section C Answer The Following

1. A sound wave of frequency 500 Hz is producing longitudinal waves in air. The distance between two consecutive rarefactions in the wave is 0.64 m and the amplitude of the oscillation of air particle is 0.002 m. Obtain the displacement equation of this wave.



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2. For steel the Young modulus of elasticity is  $2.9 \times 10^{11} Nm^{-2}$  and density is  $8 \times 10^3 kgm^{-3}$ . Find the velocity of the longitudinal waves in steel.



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3. What do you mean by impulse of a force ?  
Obtain the relation between impulse and momentum.



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4. Find a unit vector perpendicular to both the vectors.

$$\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k} \text{ and } \vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}.$$



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5. State the work-energy theorem



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6. An automobile moves on a road with a speed of 54 km/h. The radius of its wheels is 0.35 m. What is the average negative torque transmitted by its brakes to a wheel if the vehicle is brought to rest in 15 s? The moment of inertia of the wheel about its axis of rotation is  $3 \text{ kg}\cdot\text{m}^2$ .



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7. If earth suddenly contracts to half of its present radius keeping its mass constant what would be the length of the day?



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8. Explain surface energy of a liquid. What is the relation between surface tension and surface energy ?



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## Section D Answer The Following

1. Write and explain law of conservation of linear momentum. Give two examples based on this conservation.



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2. A man walks on a straight road from his home to market 2.5 km away with speed of 5 km/h. Finding the market closed, he instantly turns and walks back with a speed of 7.5 km/h.

What is the magnitude of average velocity and average speed of the man over the interval of time (i) 0 to 30 min (ii) 0 to 50 min (iii) 0 to 40 min ?



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3. What is the relation between the period of revolution of a satellite (revolving close to the earth surface) and the density of the earth?



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4. How will you weigh the Sun. to estimate its mass ? The mean orbital radius of the earth around the Sun is  $1.5 \times 10^8$  km.



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5. 10 gram of water at  $45^\circ C$  is added to 5 gram of ice at  $-30^\circ C$ . Find the final temperature of the mixture. Specific heat of ice is  $0.55 \text{ cal } g^{-1} \text{ } ^\circ C^{-1}$  and that of water is  $1.0 \text{ cal } g^{-1} \text{ } ^\circ C^{-1}$  latent heat of fusion of ice is  $80 \text{ cal } g^{-1}$  ?

(ii) To rise the temperature of 100 gram of water from  $24^{\circ}$  to  $90^{\circ} C$  by steam at  $100^{\circ} C$  .

Calculate the amount of steam required.

Specific heat of water is  $1.0 \text{ cal } g^{-1} \text{ }^{\circ} C^{-1}$ .

Latent heat of steam is  $540 \text{ Cal } kg^{-1}$ .



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6. At  $27^{\circ} C$  two moles of an ideal monatomic gas occupy a volume.  $V$  The gas expands adiabatically to a volume  $2V$ . Calculate (i) Final temperature of the gas (ii) change its internal

energy and (ii) Workd done by the gas during  
this process. Given

$$R = 8.31J / \text{mol}K, (2)^{2/3} = 1.587$$



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