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## CLASS XI PHYSICS FULL LENGTH TEST

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

***Instructions:***

***a. All questions are compulsory.***

***b. The question paper consists of 26 questions divided into three sections A, B, C, D and E. Section A comprises of 5 questions of 1 mark each, Section B comprises of 5 questions of 2 marks each, Section C comprises of 12 questions of 3 marks each, Sections D comprises of 1 questions of 4 marks and Section E comprises of 3 questions of 5 marks each.***

***c. All questions is Section A are to be answered in one word, one sentence or as per the exact requirement of the question.***

***d. 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 alternative in all such questions.***

### SECTION-A

**1.** Define the term inertia. Name the different types of inertia.

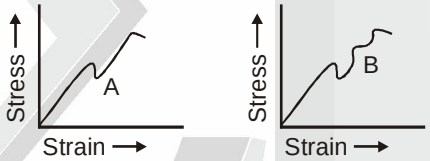
**2.** Two equal drops of water falling through air with a steady velocity *v*. If the drops coalesced, what will be the new steady velocity?

**3.** A screw gauge has a pitch of 1 mm and 200 divisions on the circular scale. Do you think it is possible to increase the accuracy of the screw gauge arbitrarily by increasing the number of divisions on the circular scale?

**4.** State whether we can use the equations of kinematics to find the height attained by a body projected upwards with any velocity.

**5.** Given below are the graphs between stress and strain for two materials A and B :

**i.** Which material has greater Young's modulus? **ii.** Which material is more ductile?




### SECTION-B

**6.** A copper wire of length 2.2 m and a steel wire of length 1.6 m, both of diameter 3 mm are connected end to end. When stretched by an external force, the net elongation is found to be 0.70 mm. Calculate the force applied. Young's modulus of copper is $1.1 \times 10^{11}$ $Nm^{-2}$ and Young's modulus of steel is $2 \times 10^{11}$ $Nm^{-2}$.

**7.** Give the statement of law of equipartition of energy and using this, find the relation for the total energy of a mole of monoatomic gas.

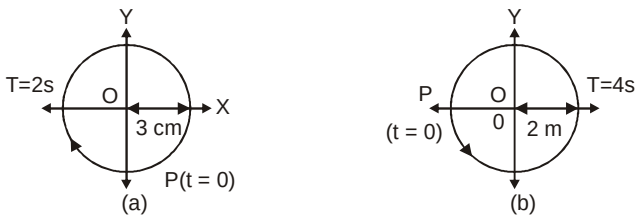
**8.** State some characteristics of a standard unit.

**9.** Show that for a particle executing SHM, velocity and displacement have a phase difference of $\pi/2$.

**OR**

Calculate the work done for adiabatic expansion of a gas.

**10.** The following figures correspond to two circular motions. The radius of the circle, the period of revolution, the initial position and the sense of revolution (i.e. clockwise or anti-clockwise) are indicated on each figure.



## SECTION-C

**11.** Explain.

**i.** Whether it is possible that the brakes of a car are so perfect that the car stops instantaneously. If not, why?

**ii.** Why is the speed, in general greater than the magnitude of velocity?

**iii.** Why do a body having a varying velocity possess constant speed?

**12.** **i.** A uniform rope of length 12 m and mass 6 kg hangs vertically from a rigid support. A block of mass 2 kg is attached to the free end of the rope. A transverse pulse of wavelength 0.06 m is produced at the lower end of the rope. What is the wavelength of the pulse when it reaches the top of the rope?

**ii.** A sitar wire is replaced by another wire of same length and material but of three times the earlier radius. If the tension in the wire remains the same, by what factor will the frequency change?

**13.** Consider a liquid drop of surface tension S and radius R. The molecules lying on the surface drop, due to surface tension will experience a resultant force acting inwards perpendicular to the surface. Since, the size of liquid drop cannot be reduced to zero due to force of surface tension, therefore the pressure inside the drop must be greater than the pressure outside it. Assuming the drop is in equilibrium, then obtain an expression for this excess of pressure inside the drop in terms of S and R.

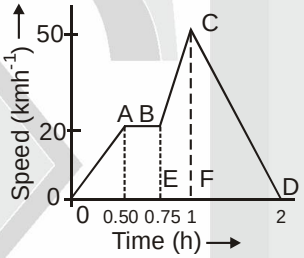
**14.** State and explain perpendicular axes theorem. Using this theorem compute moment of inertia of a disc of mass M and radius R about any diameter.

**OR**

What do you mean by centre of mass of a rigid body. Four particles of mass 1 kg, 2 kg, 3 kg and 4 kg are placed at four vertices D, E, F and G of a square of side 1 m. Find the position of centre of mass of all these particles.

**15.** With the help of suitable figures, show that the elastic force of a spring is a conservative force.

**16.** A train moves from one station to another in two hours time. Its speed-time graph during the motion is shown in figure. (i) Determine the maximum acceleration during the journey, (ii) Also, calculate the distance covered during the time interval from 0.75 h to 1 h.




**17.** When a ball is thrown vertically upwards with a velocity of 29.4 $ms^{-1}$, then after 3 s, another ball is thrown upwards from the same point with a velocity of 19.6 $ms^{-1}$. At what time and height, will the two balls collide?

**18.** State and explain first law of thermodynamics. 1g of water at 100°C is converted into steam at the same temperature. If the volume of steam is 1671 $cm^3$, find the change in internal energy of the system. Latent heat of steam = 2256 $Jg^{-1}$. Given, 1 atmospheric pressure is equal to $1.013 \times 10^5$ $Nm^{-2}$.

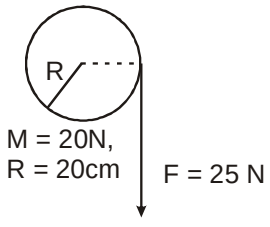
**19.** State Avogadro's law and Dalton's law partial pressure.

Also, deduce Dalton's law of partial pressure from the kinetic theory of gases.

**20.** Define standing wave. Displacement of a string in which standing wave is formed is given as Y = (20 sin 157 x cos 314 t). Find: (i) amplitude of individual waves (ii) velocity of wave.

**21.** Answer the following questions.

(i) A cord of negligible mass is wound round the rim of a flywheel of mass 20kg and radius 20cm. A steady pull of 25 N is applied on the cord as shown in figure. The flywheel is mounted on a horizontal axle with frictionless bearings.




(ii) A solid disc and a ring, both of radius 10 cm are placed on a horizontal table simultaneously, with initial angular speed equal to the $10\pi$ $rads^{-1}$. Which of the two will start to roll earlier? The coefficient of kinetic friction $\mu_k = 0.2$.

**22.** (i) To simulate car accidents, auto manufactures study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000 kg moving with a speed 15 $kmh^{-1}$ on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^3$ $Nm^{-1}$. What is the maximum compression of the spring?

(ii) If coefficient of friction between the car and the road is $\mu = 0.5$, calculate the maximum compression of the spring.

**23.** Last month, a group of men were playing cricket in a park. The match started with team A which has experienced players and was very famous for their batting lines. They batted brilliantly and made a good score. Team B which had some new players tried to come upto the mark but got all out with 2 runs short and were very disappointed. At the prize ceremony, the captain of team A praised team B for their excellent effort and said that the winning does not matter but efforts do.

(i) List the qualities did the captain of team A show.

(ii) A cricket ball of mass 150g is moving with a velocity of 12 $ms^{-1}$ and is hit by a bat, so that the ball is truned back with a velocity of 20 $ms^{-1}$. If the duration of contact between the ball and the bat is 0.01 s, find the impulse and the average force exerted on the ball by the bat.

(iii) What is the force acting between a bat and ball called?

**SECTION-E**

**24.** (i) Briefly explain the launching principle of an artificial satellite. Why is it in a state of weightlessness?

(ii) Define gravitational potential energy of a body. Derive an expression for the gravitational potential energy of body of mass m located at a distance r from the centre of the earth.

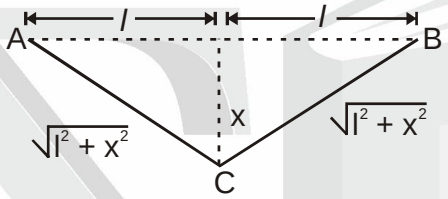
**OR**

(i) Define escape velocity.

(ii) Derive an expression for the escape velocity of a body from the surface of the earth.

(iii) Jupiter has a mass 318 times that of the earth and its radius is 11.2 times that of the earth's radius. Determine the escape velocity of a body from jupiter's surface, given that the escape velocity from the earth's surface is 11.2 $kms^{-1}$.

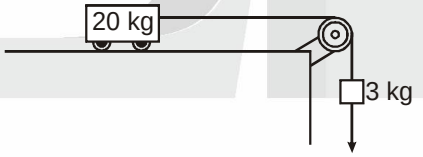
**25.** A steel wire of length 2l and cross-sectional area A is stretched within elastic limit as shown in figure. Calculate the strain and stress in the wire.




**OR** (i) State Archimedes' principle and prove it mathematically. Derive an expression for the apparent weight of the immersed body.

(ii) Compare weight and upthrust acting on the body for different cases and explain the law of floatation. Deduce an expression for the fraction of volume of the floating body submerged in liquid.

**26.** (i) What is the acceleration of the block and the trolley system in figure, if the coefficient of kinetic friction between the trolley and the surface is 0.04? What is the tension in the string? Take, g = 10$ms^{-2}$. Neglect the mass of the string.




(ii) A block of mass M is held against a rough vertical wall pressing it with a finger. If the coefficient of friction between the block and the wall is $\mu$ and the acceleration due to gravity is g, calculate the minimum force required to be applied by the finger to hold the block against the wall.

**OR**

(i) The displacement vector of a particle of mass m is given by $r(t) = \hat{i}\, A \cos \omega t + \hat{j}\, B \sin \omega t$

(a) Show that the trajectory is an ellipse. (b) Show that $\mathbf{F} = -m\omega^2\mathbf{r}$

(ii) Rain is falling vertically with a speed of 30$ms^{-1}$. A woman rides a bicycle with a speed of 10$ms^{-1}$ in the North to South direction. What is the relative velocity of rain with respect to the woman? What is the diretion in which she should hold her umbrella to protect herself from the rain?