ASSIGNMENT FOR THE SESSION 2013-2014

Class: XI   **Subject: Physics**   **Assignment No. 3**

1. The angle of contact of mercury with glass is obtuse, while that of water is acute . Why?

2. Water can rise upto a height of 10cm in a capillary. If a capillary of the same diameter but of length 8cm is held vertically in water, will the water come out in the form of fountain ?

3. If a capillary tube in water in state of weightlessness, how will the rise of water in it be different to that observed in normal condition?

4. A liquid is kept in a cylindrical vessel which is rotated about its axis. The liquid rises at the sides. If the radius of the vessel is 0.05m and speed of rotation is 2rev/sec, find the difference in the height of the liquid at the centre of the vessel and its sides.

5. A cylindrical 1m in radius rest on a platform 5m high. Initially the tank is filled with water to a height of 5m. A plug whose area is 10^{-4} m^2 is removed from an orifice on the sides of the tank at the bottom. Calculate initial speed with which the water flows from the orifice, initial speed with which water strikes the ground.

6. Water stands at a height H in a tank whose side walls are vertical. A hole is made in one of the wall at a depth h below the water surface. Find at what distance from the foot of the wall does the emerging stream of water strike the floor and for what value of h this range is maximum.

7. Under isothermal condition two soap bubble of radii a and b coalesces to form a single bubble of radius c . If external pressure is p_0 find an expression for surface tension in terms of p_0, a b and c.

8. What is the mean kinetic energy of a molecule of a gas at 300 k temperature? What will be thermal speed of a molecule of H_2 gas at this temp?

9. A body cools in 7min from 60^0C to 40^0C. What will its temp in next 7 min? The temp of the surrounding is 10^0C.

10. State the first law of thermodynamics. Apply it for adiabatic process, cyclic, isochoric, isobaric process. Hence establish the Mayer relation.

11. The pressure in a monoatomic gas increases linearly from $4 \times 10^5 N/m^2$ to $8 \times 10^5 N/m^2$ when its volume increases from $0.2m^3$ to $0.5m^3$. Calculate i) work done by the gas ii) increase in the internal energy iii) amount of heat supplied iv) molar heat capacity of the gas.

12. A tunnel is dug across the earth passing through the centre. If a body be dropped at one end of the tunnel, then prove that its time period will be same as that of a satellite revolving near the earth.

13. Obtain expressions for kinetic and potential energies of a body executing SHM. Prove that its total energy is proportional to the square of the amplitude of oscillation.

14. What is a plane progressive simple harmonic wave? Establish equation for this wave in two different forms.

15. The equation of motion of a wave is y=1.2 sin(3.5t+.5x), where distances and time are expressed in m and sec respectively .Determine the velocity and direction of the wave.

16. Derive the expression for orbital velocity of a satellite moving round the earth if earth has a mass M and radius R.

17. Obtain an expression for the acceleration of a cylinder rolling down an inclined plane without slipping. Also obtain an expression for the co-efficient of friction necessary for it.

18. A cylinder of mass 10 kg and radius 15 cm is rolling perfectly on a plane of inclination of 30^0. The coefficient of static friction is equal to 0.25.

    a) How is the force of friction acting on the cylinder? b) What is the work done against friction during rolling?

19. A body weight 63 N on the surface of the earth what is the gravitational force on it due to the earth at a height equal to the half radius of the earth?

20. What is gravitational potential energy, find its expression?

21. Mr. Sriram returns home from an official trip in first week of March and finds that a loudspeaker is operating in the locality at 11:30 pm. Realizing that this is exam time for almost everyone, he directly goes to the ceremony site. He talks to the hosts and requests them to reduce the volume or switch off loudspeakers. He also apprises them of the law against use of the same after 10pm.
    a) What are two human qualities exhibited by Mr Sriram in the above case?
    b) Write an expression for the velocity of sound in air. On what factors does the speed of sound depends upon?