INDIAN SCHOOL AL WADI AL KABIR

Class: XI	**Department: SCIENCE 2020 -21** **SUBJECT: PHYSICS**	**Date of submission:** **29.11.2020**
Worksheet No:09 **WITH ANSWERS**	**Topic:** **MECHANICAL PROPERTIES OF FLUIDS**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT-	**CLASS & SECTION**	**ROLL NO.**

Multiple choice questions:

1. A block of aluminium of mass 1 kg and volume 3.6 x 10^{-4} m^3 is suspended from a string and then completely immersed in a container of water. The decrease in tension in the string after immersion is (use g = 10 ms^{-2})

(a) 9.8 N (b) 6.2 N (c) 3.6 N (d) 1.0 N

2. A U-tube is partially filled with water. Oil which does not mix with water is next poured into one side until water rises by 25 cm on the other side. If the density of oil be 0.8, the oil level will stand higher than the water level by

(a) 6.25 cm (6) 12.50 cm (c) 31.75 cm (d) 62.50 cm

3. Two water droplets merge with each other to form a larger droplet. In this process

(a) energy is liberated
(b) energy is absorbed
(c) energy is neither liberated nor absorbed
(d) some mass is converted into energy

4. A long cylindrical glass vessel has a small hole of radius r at its bottom. The depth to which the vessel can be lowered vertically in a deep water (surface tension S) without any water entering inside is

(a) $\frac{4S}{r\rho g}$ (b) $\frac{3S}{r\rho g}$ (c) $\frac{2S}{r\rho g}$ (d) $\frac{S}{r\rho g}$

5. Two soap bubbles A and B are formed at the two open ends of a tube. The bubble A is smaller than bubble B. If the valve on the tube connecting the two bubbles is opened and air can flow freely between the bubbles, then

(a) there is no change in the size of the bubbles
(b) the two bubbles will become of equal size
(c)A will become smaller and B will become larger
(d) B will become smaller and A will become larger

6. The work done in increasing the size of a soap film from 10 cm x 6 cm to 10 cm x 11 cm is 3 x 10^{-4}J. The surface tension of the film is

(a) 1.5 x 10^{-2} Nm^{-1} (b) 3.0 x 10^{-2} Nm^{-1} (c) 6.0 x 10^{-2} Nm^{-1} (d) 11.0 x 10^{-2} Nm^{-1}

7. What change in surface energy will be noticed when a drop of radius R splits up into 1000 droplets of radius r, surface tension is T.

(a) $4\pi R^2T$ (b)7 πR^2T (c)16 πR^2T (d)36 πR^2T

8. In a surface tension experiment with a capillary tube water rises up to 0.1 m. If the same experiment is repeated on an artificial satellite, which is revolving around the earth, water will rise in the capillary tube up to a height of

(a) 0.1 m (b) 0.2 mn (c) 0.98 m (d) full length of tube.

9. A capillary tube of radius R is immersed in water and water rises in it to a height H. Mass of water in capillary tube is M. If the radius of the tube is doubled, mass of water that will rise in capillary will be

(a) 2 M (b) M (c) M/2 (d) 4 M

10. A capillary tube is dipped in water with the lower end 10 cm below the surface. Water rises in the tube to a height of 5 cm. The pressure required to blow a bubble at the lower end of the tube will be (atmospheric pressure = 10^5 Nm^{-2} and g = 10 m/s^2)

(a) 10^5 Nm^{-2} (b) 1.015 x 10^5 Nm^{-2} (c)2.2 x 10^5 Nm^{-2} (d) 2.5 x 10^5 Nm^{-2}

11. Under a pressure head, the rate of orderly volume of liquid flowing through a capillary tube is *Q*. If the length of capillary tube were doubled and diameter of the bore is halved, the rate of flow would become

(a) Q/4 (b) Q/8 (c) Q/32 (d) 16 Q

12. When water flows at a rate *Q* through a tube of radius *r* placed horizontally, a pressure difference *p* develops across the ends of the tube. If the radius of the tube is doubled and the rate of flow halved, the pressure difference will be

(a) 80 p (b) p (c) p/8 (d) p/32

13. Two spheres of equal masses but radius r_1 and r_2 are allowed to fall in liquid of infinite column. The ratio of their terminal velocities is

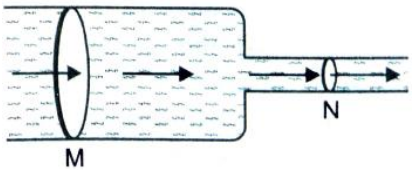
(a) 1 (b) r_1: r_2 (c) r_2: r_1 (d) $\sqrt{r1}$: $\sqrt{r2}$

14. Two drops of the same radius are falling through air with a steady velocity of 5 cm s^{-1} • If the two drops coalesce, the terminal velocity would be

(a) 10 cms^{-1} (b) 2·5 cms^{-1} (c) 5 $(4)^{1/3}$ cm s^{-1} (d) 5 $(3)^{1/3}$ cm s^{-1}

15. A horizontal tube of non-uniform cross-section has radii of 0·1 m and 0·05 m respectively at M and N, as shown in the fig. For a streamline flow of liquid, the rate of liquid flow is

(a) continuously changes with time
(b) greater at M than at N
(c) greater at N than at M
(d) same at Mand N



16. For a ball falling in a liquid with constant velocity, ratio of resistance force due to the liquid to that due to gravity is

(a) 1 (b) $\frac{2a^2\rho g}{9\eta^2}$ (c) $\frac{2a^2(\rho-\sigma)g}{9\eta}$ (d) none of these.

17. There is a hole at the bottom of a large open vessel. If water is filled up to a height h, it flows out in time t. If water is filled to a height 4 h, it will flow out in time

(a) 4 t (b) t/4 (c) t/2 (d) 2 t

18. The work done by pressure in forcing 1 m^3 of water through a pipe if the pressure difference across the pipe is 10^4 Pa, is

(a) 10^5 J (b) 10^4 J (c) 10^3 J (d) 10^2 J

19. The tangential force or viscous force on any layer of the liquid is directly proportional to the velocity gradient *dv/dx*. Then the direction of velocity gradient is

(a) parallel to the direction of the flow of the liquid
(b) opposite to the direction of the flow of the liquid
(c) independent of the direction of the flow of the liquid
(d) perpendicular to the direction of flow of the liquid

20. It is observed that during storm, the roofs of some houses are blown off. It is because
(a) the wind creates high pressure over the roof
(b) the wind creates low pressure over the roof
(c) of the structure and shape of the roof
(d) of natural calamity

1. Pressure is a.....quantity.
2. Mean pressure on the walls of a beaker containing liquid upto height h, of density ρ is..... .
3. The.....at a point in a liquid is the difference of total pressure at that point and atmospheric pressure.
4. The weight of a vertical column of air of unit cross-sectional area extending from a point to the top of the earth's atmosphere is called.....at that point.
5. The upward force acting on the body immersed in a fluid is called.....force.
6. If two liquids of same mass m but of different densities ρ_1 and ρ_2 are mixed together, then the density of the mixture is..... .
7. The maximum distance upto which a molecule can exert some measurable attraction on other molecules is called..... .
8. When mercury is split on a clean glass plate, it..... .
9. Oil drop may.....on a hot water.
10. Surface energy per unit area of liquid surface is called..... .

1. scalar	**2.** $h \rho g/2$	**3.** gauge pressure	**4.** atmospheric pressure
5. buoyant	**6.** $\frac{2\rho_1 \rho_2}{(\rho_1 + \rho_2)}$	**7.** molecular range	**8.** forms globules
9. remain as a drop	**10.** surface tension of liquid.		

1. With increase in temperature, the viscosity of liquid.....but viscosity of gases..... .
2. If 1 newton tangential force is required to maintain the velocity gradient of 1 ms^{-1}/m between two parallel layers of liquid each of area 1 sq m, the coefficient of viscosity of liquid is said to be..... .
3. The reciprocal of viscosity is called..... .
4. The maximum constant velocity acquired by the body while falling freely in a viscous medium is called..... .
5. With increase in pressure, the viscosity of liquid.....but the viscosity of water..... .
6. The velocity of liquid flow, upto which its flow is streamlined and above which its flow becomes turbulent is called..... .
7. In river, the deep water runs.....and less deep water runs..... .
8. The equation of continuity represents the conservation of.....in case of moving fluids.
9. Bernoulli's theorem is an outcome of the conservation of.....applied to a liquid in motion.
10. A device used for measuring the rate of flow of liquid through pipes is called..... .

1. decreases ; increases	**2.** 1 Pl or 1 Pa-s	**3.** fluidity	**4.** terminal velocity
5. increases, decreases	**6.** critical velocity	**7.** slow, fast	**8.** mass
9. energy	**10.** venturimeter.		

ANSWERS OF MCQs; -1. (c),2. (a), 3. (a), 4. (c), 5. (c), 6. (b), 7. (d), 8. (d), 9. (a), 10. (b), 11. (c), 12. (d), 13. (c), 14. (c), 15. (d),16. (a), 17. (d), 18. (b),19. (a), 20. (b).

Assertion and Reason type questions;

DIRECTIONS. In each of the following questions, read the two statements and choose if
(A) both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
(B) both Assertion and Reason are true, but the Reason is not a correct explanation of the Assertion.
(C) Assertion is true and Reason is false.
(D) both, Assertion and Reason are false.

1. Assertion. The stream of water flowing at high speed from a garden hose pipe tends to spread like a fountain when held vertically up but tends to narrow down when held vertically down.
Reason. In any steady flow of an incompressible fluid, the volume flow rate of the fluid remains constant.
(a)(A) (b) B (c) C (d) D

2. Assertion: A bubble comes from the bottom of a lake to the top.
Reason: Its radius increases.
(a)(A) (b) B (c) C (d) D

3. Assertion: The angle of contact of a liquid with a solid decrease with increase in temperature.
Reason: With increase in temperature, the su1facc tension of the liquid increases.
(a)(A) (b) B (c) C (d) D

4. Assertion: A needle; placed carefully on the surface of water may float, whereas a ball of the same material will always sink.
Reason: The buoyancy on an object depends both on the material and shape of the object.
(a)(A) (b) B (c) C (d) D

5. Assertion: Aeroplanes are made to nm on the runway before takeoff, so that they acquire the necessary lift.
Reason: According to Bernoulli's theorem as velocity increases pressure decreases and vice-versa.
(a)(A) (b) B (c) C (d) D

ANSWERS OF A &R; -1. (a),2. (b), 3. (d), 4. (c), 5. (a),

SHORT ANSWER TYPE QUESTIONS: -

1. Find the pressure at the tip of a drawing pin of area 0.2 mm square if it is pushed against a board with a force of 5 kg wt.

Solution. Here, $A = 0{\cdot}2$ mm sq
$= 0{\cdot}2 \times 0{\cdot}2$ sq mm $= 0{\cdot}04 \times 10^{-6}$ m^2,
$F = 5$ kg wt $= 5 \times 10$ N

Pressure, $P = \frac{F}{A} = \frac{5 \times 10}{\cdot 04 \times 10^{-6}} = \mathbf{1{\cdot}25 \times 10^9\ Pa}$

2. Force on a phonograph needle is 120 gf. The needle end has a circular cross-section of radius 0.1 mm. Find the pressure (in atm) it exerts on the record. Given, 1 atm = 1.013 x 10^5 Pa. Use g = 10 ms^2.

Solution. Here, $F = 120\ gf = 0{\cdot}120$ kg f

$= 0{\cdot}120 \times 10 = 1{\cdot}2$ N,

$r = 0{\cdot}1$ mm $= 10^{-4}$ m

Pressure, $P = \dfrac{F}{\pi r^2} = \dfrac{1{\cdot}2}{(22/7)\times(10^{-4})^2}$ Pa

$= \dfrac{1{\cdot}2\times 7}{22\times 10^{-8}\times 1{\cdot}013\times 10^5}$ atm $=$ **377 atm**

3. What is the pressure on a swimmer 10 m below the surface of lake? g = 10 ms^2, atmospheric pressure = 1.01 x 10^5 Pa.

Solution. Here, $h = 10$ m, $P_a = 1{\cdot}01 \times 10^5$ Pa

Total pressure $= P_a + \rho\, g\, h$

$= 1{\cdot}01 \times 10^5 + 1000 \times 10 \times 10$

$= 2{\cdot}01 \times 10^5$ Pa $\approx$ **2 atm**

4. The density of the atmosphere at sea level is 129 kg/m^3. Assume that it does not change with altitude. Then how high would the atmosphere extend? g = 9.8 ms^2, Atmospheric pressure =1.013 x 10^5 Pa.

Solution. Atmospheric pressure, $P_a = h\,\rho\, g$

or $h = \dfrac{P_a}{\rho\, g} = \dfrac{1{\cdot}013\times 10^5}{1{\cdot}29\times 9{\cdot}8} =$ **7989 m**

5. A cylinder has a radius 20 cm. To what height should it be filled with water so that thrust in its walls is equal to that on its bottom? Find the mass of water filled in cylinder.

Solution. Let h be the height of water filled in cylinder and ρ be the density of water. Then

thrust at the bottom of vessel

$F =$ pressure $\times$ area $= (h\,\rho\, g) \times \pi r^2$

Thrust on the walls of vessel,

F' = average pressure $\times$ area

$$F' = \left(\frac{h\rho g}{2}\right) \times (2\pi rh) = \pi rh^2 \rho g$$

When $F = F'$, then $h\,\rho\, g \times \pi r^2 = \pi\, rh^2\, \rho\, g$

or $h = r =$ **20 cm**

6. To lift an automobile of 2000 kg, a hydraulic pump with a large piston 30 cm^2 in area is employed. Calculate the force that must be applied to pump a small piston of mercury area 10 cm^2 to achieve it.

Solution. Here, $F_2 = Mg = 2000 \times 9{\cdot}8 = 19600$ N

$A_2 = 30$ cm square $= 30 \times 30$ sq cm

$= 900 \times 10^{-4}$ m^2

$A_1 = 10$ sq cm $= 10 \times 10^{-4}$ m^2

As $\dfrac{F_1}{A_1} = \dfrac{F_2}{A_2}$ so $F_1 = \dfrac{F_2 \times A_1}{A_2}$

$= \dfrac{19600\times 10\times 10^{-4}}{900\times 10^{-4}}$

$=$ **217·8 N**

7. Two syringes of different cross-sections (without needles) filled with water are connected with a tightly fitted rubber tube filled with water. Diameters of the smaller piston and larger piston are 10 cm and 3.0 cm respectively. (a) Find the force on the larger piston when a force of 10 N is applied to the smaller piston. (b) The smaller piston is pushed in through 6.0 cm, how much does the larger piston move out?

(*a*) As, $F_2 = F_1 \times \frac{A_2}{A_1} = F_1 \times \frac{\pi(D_2/2)^2}{\pi(D_1/2)^2}$

$$= F_1 \frac{D_2^2}{D_1^2} = 10 \times \frac{3^2}{1^2} = \mathbf{90\,N}$$

(*b*) According to work energy principle,

$F_1 l_1 = F_2 l_2$

or $l_2 = \frac{F_1}{F_2} l_1 = \frac{10}{90} \times \frac{6}{100} = 6{\cdot}7 \times 10^{-3}$ m

$= \mathbf{6{\cdot}7\ mm}$

8. Machine parts are jammed in winter. Why?

Ans: - lubricating oil is generally used between various parts of a machine to reduce the friction in winter, since the temperature is low viscosity of oil between the machine parts increases considerably, resulting in jamming the machine parts.

9. Discuss the effect of temperature on viscosity of liquids and gases.

Ans: -The viscosity of liquid decreases rapidly with rise of temperature.

10. Are there some conditions for Stoke's law to be obeyed. If no, explain. If yes, mention those conditions.

Ans: -Yes,

1. The body falling in the viscous medium must be perfectly rigid and smooth.
2. There is no slip between the body and the medium.
3. The motion of body in the medium does not cause any turbulent motion or eddies in the medium.
4. The size of the body must be small but it should be greater than the distance between the
5. The medium is homogeneous and continuous for a moving body in it.

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