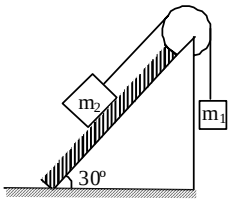
1. What is the velocity v of a metallic ball of radius r falling in a tank of liquid at the instant when its acceleration is one half that of a freely falling body ? (The densities of metal and of liquid are ρ and σ respectively and the viscosity coefficient of the liquid is η) -

(A) $\frac{r^2g}{9\eta}(\rho - 2\sigma)$ (B) $\frac{r^2g}{9\eta}(2\rho - \sigma)$ (C) $\frac{r^2g}{9\eta}(\rho - \sigma)$ (D) $\frac{2r^2g}{9\eta}(\rho - \sigma)$

2. The mass of block m_1 = 4 kg and m_2 = 20 kg, m_2 slides on the incline on a film of oil 7μm thick. Assume linear velocity profile. Block m_2 is cube of length 10cm. viscosity of oil is 7×10^{-3} Pa-s : Terminal velocity of blocks is



(A) 2 m/s (B) 6 m/s (C) 4 m/s (D) 5 m/s

3. The velocity of a small ball of mass M and density d_1, when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is d_2, the viscous force acting on the ball will be

(A) $\frac{M\,d_1g}{d_2}$ (B) $M\,g\left(1-\frac{d_2}{d_1}\right)$ (C) $\frac{M(d_1+d_2)}{g}$ (D) $\frac{Md_2g}{d_1}$

4. A wide jar is filled with glycerin having specific gravity 1.26, in this jar a steel ball of radius 0.25 cm has been dropped. After some time it has observed that ball is taking equal interval of time 1.8 sec to cover equal successive distances of 20 cm. The viscosity of glycerin in N-s/m^2 would be [$\rho_{steal} = 7.8 \times 10^3$ kg/m^3, g = 9.8 m/s^2]-

(A) 0.833 (B) 1.67 (C) 0.76 (D) 0.963

5. A solid ball of density ρ_1 and radius r falls vertically through a liquid of density ρ_2. Assume that the viscous force acting on the ball is F = krv, where k is a constant and v its velocity. What is the terminal velocity of the ball ?

(A) $\frac{4\pi r^2(\rho_1-\rho_2)g}{3k}$ (B) $\frac{2\pi r(\rho_1-\rho_2)}{3gk}$ (C) $\frac{2\pi g(\rho_1+\rho_2)}{3gr^2k}$ (D) none of these

6. A newtonion fluid fills the clearance between a shaft and a sleeve. When a force of 800 N is applied to the shaft, parallel to the sleeve, the shaft attains a speed of 2 cm/s. If a force of 2.4 kN is applied instead, the shaft would move with a speed of -

(A) 2 cm/s (B) 15 cm/s (C) 6 cm/s (D) None of these

7. A small drop of steel falls from rest through a long height h in coaltar, the final velocity will be proportional to h^n, then n is -

(A) 1/2 (B) 1 (C) – 1 (D) 0

8. A small lead ball is falling freely in a viscous liquid. The velocity of the ball

(A) goes on increasing (B) goes on decreasing

(C) remains constant (D) first increases and then becomes constant

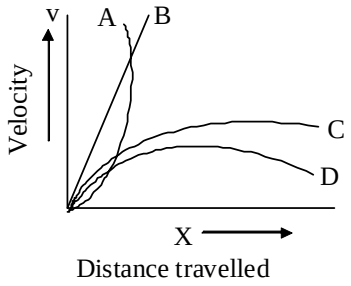
9. The terminal velocity of a spherical ball of radius r falling through a viscous liquid is proportional to –

(A) r (B) r^2 (C) r^3 (D) r^{-1}

10. The viscous force acting on a solid ball moving in air with terminal velocity v is directly proportional to -

(A) $\sqrt{v}$ (B) v (C) $\frac{1}{\sqrt{v}}$ (D) v^2

11. A small spherical solid ball is dropped in a viscous liquid. Its journey in the liquid is best described in the figure by



(A) Curve A (B) Curve B (C) Curve C (D) Curve D

12. The relative velocity between two parallel layers of water is 8 cm/s and the perpendicular distance between them is 0.1 cm. Calculate the velocity- gradient -

(A) 90/s (B) 85 /s (C) 80 /s (D) None of these

13. There is a 1 mm thick layer of oil between a flat plate of area 10^{-2} m^2 and a big plate. How much force is required to move the plate with a velocity of 1.5 cm/s ? The coefficient of viscosity of oil is 1 poise -

(A) 1.5×10^{-3} N (B) 1.5×10^{-5} N (C) 1.5×10^{-2} N (D) 1.5×10^{2} N

14. An air bubble (radius 0.4 mm) rises up in water. If the coefficient of viscosity of water be 1×10^{-3} kg/(m/s), then determine the terminal speed of the bubble density of air is negligible-

(A) 0.843 m/s (B) 3.048 m/s (C) 0.483 m/s (D) 0.348 m/s

15. The terminal velocity of a ball in air is v, where acceleration due to gravity is g. Now the same ball is taken in a gravity free space where all other conditions are same. The ball is now pushed at a speed v, then –

(A) The terminal velocity of the ball will be v/2

(B) The ball will move with a constant velocity

(C) The initial acceleration of the ball is 2g in opposite direction of the ball's velocity

(D) The ball will finally stop (Given that density of the ball ρ = 2 times the density of air σ)

16. A tank is filled up to a height 2H with a liquid and is placed on a platform of height H from the ground. The distance x from the ground where a small hole is punched to get the maximum range R is -

(A) H (B) 1.25 H (C) 1.5 H (D) 2H

17. Two rain drops reach the earth with their terminal velocities in the ratio 4 : 9. The ratio of their radii is -

(A) 4 : 9 (B) 2 : 3 (C) 3 : 2 (D) 9 : 4

Answers

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1. (D) **2.** (B) **3.** (B) **4.** (A) **5.** (A) **6.** (C) **7.** (D) **8.** (D) **9.** (B) **10.** (B)
11. (C) **12.** (C) **13.** (C) **14.** (D) **15.** (D) **16.** (C) **17.** (B)