PHYSICS CLASSES

D.K.Singla (M.Sc., Ph.D.Thapar Uni.)

Motion In One Dimension (Test-4) , Class+1

1 . (d) $\frac{v_A}{v_B} = \frac{\tan\theta_A}{\tan\theta_B} = \frac{\tan 30^\circ}{\tan 60^\circ} = \frac{1/\sqrt{3}}{\sqrt{3}} = \frac{1}{3}$

2. (b)Distance travelled by train in first 1 *hour* is 60 *km* and distance in next 1/2 *hour* is 20 *km*. So Average speed $= \frac{\text{Total distance}}{\text{Total time}} = \frac{60+20}{3/2} = 53.33\ km/hour$

3. (d)

4. (d)A man walks from his home to market with a speed of $5\ km/h$ **.Distance** $= 2.5\ km$ **and time** $= \frac{d}{v} = \frac{2.5}{5} = \frac{1}{2}hr$ **.**

and he returns back with speed of $7.5\ km/h$ **in rest of time of 10 *minutes*.**

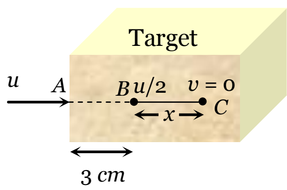
Distance $= 7.5 \times \frac{10}{60} = 1.25\ km$ **So, Average speed** $= \frac{\text{Total distance}}{\text{Total time}}$ $= \frac{(2.5+1.25)km}{(40/60)hr} = \frac{45}{8} km/hr$ **.**

5. (c) Since displacement is always less than or equal to distance, but never greater than distance. Hence numerical ratio of displacement to the distance covered is always equal to or less than one.

6. (a) When the body is projected vertically upward then at the highest point its velocity is zero but acceleration is not equal to zero $(g = 9.8 m/s^2)$**.**

7. (b) Let initial velocity of the bullet = *u*

After penetrating 3 *cm* its velocity becomes $\frac{u}{2}$



From $v^2 = u^2 - 2as$

$\left(\frac{u}{2}\right)^2 = u^2 - 2a(3)$

$\Rightarrow 6a = \frac{3u^2}{4} \Rightarrow a = \frac{u^2}{8}$

Let further it will penetrate through distance *x* and stops at point *C*.

For distance *BC*, $v = 0, u = u/2, s = x, a = u^2/8$

From $v^2 = u^2 - 2as \Rightarrow 0 = \left(\frac{u}{2}\right)^2 - 2\left(\frac{u^2}{8}\right).x \Rightarrow x = 1$ ***cm*.**

8. (c) Acceleration $= \frac{d^2x}{dt^2} = 2a_2$

9. (a) $S = \int_0^3 v\,dt = \int_0^3 kt\,dt = \left[\frac{1}{2}kt^2\right]_0^3 = \frac{1}{2} \times 2 \times 9 = 9m$

10. (a) $\frac{dt}{dx} = 2\alpha x + \beta \Rightarrow v = \frac{1}{2\alpha x + \beta}$

$\because\ a = \frac{dv}{dt} = \frac{dv}{dx}.\frac{dx}{dt}$ $a = v\frac{dv}{dx} = \frac{-v.2\alpha}{(2\alpha x+\beta)^2} = -2\alpha.v.v^2 = -2\alpha v^3$ $\therefore$ **Retardation** $= 2\alpha v^3$

11. (c) $t = \sqrt{\frac{2h}{(g+a)}} = \sqrt{\frac{2\times 2.7}{(9.8+1.2)}} = \sqrt{\frac{5.4}{11}} = \sqrt{0.49} = 0.7\sec$ **As** $u = 0$ **and lift is moving upward with acceleration**

12. (b) $a = \sqrt{a_x^2 + a_y^2} = \left[\left(\frac{d^2x}{dt^2}\right)^2 + \left(\frac{d^2y}{dt^2}\right)^2\right]^{\frac{1}{2}}$ **Here** $\frac{d^2y}{dt^2} = 0$ **. Hence** $a = \frac{d^2x}{dt^2} = 8m/s^2$

13. (d) $S \propto u^2$ **. Now speed is two times so distance will be four times** $S = 4 \times 6 = 24m$

14. (d) $u = 200\ m/s, v = 100\ m/s, s = 0.1\ m$ $\quad a = \frac{u^2 - v^2}{2s} = \frac{(200)^2 - (100)^2}{2 \times 0.1} = 15 \times 10^4\ m/s^2$

15. (d) $x \propto t^3 \ \therefore\ x = Kt^3$ $\quad \Rightarrow v = \frac{dx}{dt} = 3\ Kt^2$ **and** $a = \frac{dv}{dt} = 6\ Kt$ $\quad$ **i.e.** $a \propto t$

16. (b) Time $= \frac{\text{Total length}}{\text{Relativevelocity}} = \frac{50+50}{10+15} = \frac{100}{25} = 4\ sec$

17. (c) Time $= \frac{\text{Total length}}{\text{Relativevelocity}} = \frac{50+50}{10+15} = \frac{100}{25} = 4\ sec$ $\quad \overrightarrow{BC} =$ **Velocity of river** $= \sqrt{AC^2 - AB^2}$

$= \sqrt{(10)^2 - (8)^2} = 6\ km/hr$

18. (d) Relative velocity $= 10 + 5 = 15\ m/sec$ $\quad \therefore\ t = \frac{150}{15} = 10\ sec$

19. (d) For the round trip he should cross perpendicular to the river $\therefore$ Time for trip to that side $= \frac{1km}{4km/hr} = 0.25hr$ **To come back, again he take 0.25 *hr* to cross the river. Total time is 30 min, he goes to the other bank and come back at the same point.**

20. (c) $h = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{2h/g}$ $\quad t_a = \sqrt{\frac{2a}{g}}$ and $t_b = \sqrt{\frac{2b}{g}} \Rightarrow \frac{t_a}{t_b} = \sqrt{\frac{a}{b}}$

21. (d) The separation between the two bodies, two seconds after the release of second body

$= \frac{1}{2} \times 9.8[(3)^2 - (2)^2] = 24.5\ m$

22. (b) Time of flight $= \frac{2u}{g} = \frac{2 \times 100}{10} = 20\ sec$

23. (a) $h = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times (4)^2 = 80\ m$

24. (a) Height travelled by ball (with balloon) in 2 *sec* $h_1 = \frac{1}{2}a\,t^2 = \frac{1}{2} \times 4.9 \times 2^2 = 9.8\ m$ **Velocity of the balloon after 2 sec** $v = a\,t = 4.9 \times 2 = 9.8\ m/s$

Now if the ball is released from the balloon then it acquire same velocity in upward direction.

Let it move up to maximum height h_2 $\ v^2 = u^2 - 2gh_2 \Rightarrow 0 = (9.8)^2 - 2 \times (9.8) \times h_2 \therefore h_2$ **=4.9*m* Greatest height above the ground reached by the ball** $= h_1 + h_2 = 9.8 + 4.9 = 14.7\ m$

25. (d) Given $a = 19.6\ m/s^2 = 2g$ **Resultant velocity of the rocket after 5 *sec*** $v = 2g \times 5 = 10g\ m/s$

Height achieved after 5 *sec*, $h_1 = \frac{1}{2} \times 2g \times 25 = 245m$ **On switching off the engine it goes up to height** h_2 **where its velocity becomes zero.** $0 = (10g)^2 - 2gh_2 \Rightarrow h_2 = 490m$