WEEKLY TEST TYJ -1 TEST - 25 B
SOLUTION Date 20-10-2019

[PHYSICS]

1. It is the speed of light in free space. Hence, dimension is that of speed, *i.e.*, LT^{-1}.

2. Boltzmann's constant = energy/temperature

$$= \frac{[ML^2T^{-2}]}{[\theta]} = [ML^2T^{-2}\theta^{-1}]$$

3. The only scalar quantity in the given set is pressure.

4. Distance travelled in *n*th second,

$$s_n = u + a\left(n - \frac{1}{2}\right)$$

Distance travelled in 2nd second,

$$s_2 = 0 + a\left(2 - \frac{1}{2}\right) \quad \ldots(i)$$

Distance travelled in 5th second,

$$s_5 = 0 + a\left(5 - \frac{1}{2}\right) \quad \ldots(ii)$$

Dividing eqn. (ii) by eqn. (i), $s_5 = 24$ m

5. When the body returns to origin, displacement is zero.

$$s = ut + \frac{1}{2}at^2$$

$$0 = 60t - \frac{1}{2} \times 10 \times t^2$$

Solving, $t = 12$ s

6. $$v \propto \lambda^x \rho^y g^z$$

Putting dimensions,

$$LT^{-1} = L^x(ML^{-3})^y(LT^{-2})^x$$

Solving, we get $v \propto \sqrt{g\lambda}$.

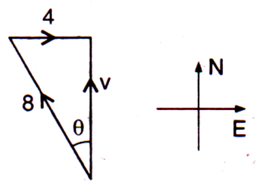
7. We know that $T \propto \sqrt{R}$. When R is doubled, T becomes $\sqrt{2}$ times.

8. The train is moving with horizontal velocity in a straight line, hence vertical ranges will be same.

For a person inside the train, the horizontal range will be zero, because train is an inertial frame. The coin falls back to his hand. For a person outside the train such as C, the coin has a horizontal velocity and vertical acceleration g. Hence, it appears to follow a parabolic path. Hence, he observes a horizontal range.

9. In order to arrive at the opposite bank, the boat should start at an angle θ with north such that $\sin\theta = \frac{4}{8}$ or $\theta = 30°$. The real velocity of boat will be,

$$v = \sqrt{8^2 - 4^2} = \sqrt{48}, \quad \theta = 30° \text{ W of N}$$



10. For a given braking force, the stopping distance $s \propto u^2$ ($\because v^2 - u^2 = 2as$). So, when velocity increases to 4 times, the stopping distance would increase to $16s$.

11. Comparing with the equation of trajectory for projectile motion,

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

We find, $\tan\theta = 16$

It is also given, $u\cos\theta = 2$

So, $\frac{u\sin\theta}{u\cos\theta} = 16, \quad \therefore \quad u\sin\theta = 32$

Now $R = \frac{2u^2}{g}\sin\theta\cos\theta = \frac{2}{g}(u\sin\theta \times u\cos\theta)$

$$= \frac{2}{10} \times 32 \times 2 = 12.8 \text{ m}$$

12. Work done = force × displacement = $100 \times \sin 50° \times 1$.

20% of this work is used to overcome friction. Hence, energy gained = 80% of this work = 80 sin 50° Joule.

13. The velocity is increasing, so KE should also be increasing. But since velocity is increasing uniformly, acceleration should be constant.

14. Here, the disc has only KE of rotation

$$= \frac{1}{2}I\omega^2 = \frac{1}{2} \times \frac{Mr^2}{2}\frac{v^2}{r^2} = \frac{1}{4}Mv^2$$

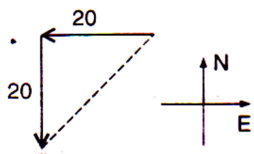
15. $(I)_{\text{solid}} = \frac{2}{5}mr^2$

$(I)_{\text{hollow}} = \frac{2}{3}mr^2$

Since, mass is same, for I to be same

$$\frac{2}{5}r_1^2 = \frac{2}{3}r_2^2 \quad \text{or} \quad \frac{r_2}{r_1} = \sqrt{\frac{3}{5}}$$

16. Change in velocity = final velocity − initial velocity. It is clear from figure, that change in velocity $= \sqrt{20^2 + 20^2} = 20\sqrt{2}$ m/s along south-west.



17. During elastic collision of equal masses, the velocities are exchanged. So, the moving mass comes to rest, and the mass initially at rest starts moving with the same velocity, *i.e.*, the moving mass transfers whole of its energy to the mass at rest.

18. Centripetal acc. $= \frac{v^2}{r} = \frac{4}{r^2}$

$\therefore\ v = 2/\sqrt{r}$ and momentum will be $2m/\sqrt{r}$.

19. Let l be the length of the plane; then

$$l = \frac{1}{2} g \sin\theta = \frac{\frac{1}{2} g t_2^2}{\frac{1}{2}(g \sin\theta) t_1^2}$$

i.e., $\frac{t_2^2}{t_1^2} = \sin^2\theta$

or $\sin\theta = \frac{t_2}{t_1} = \frac{5}{10} = \frac{1}{2}$

i.e., $\theta = 30°$

20. $\frac{dv}{dt} = 2t + 1$

$\therefore$ $v = \frac{2t^2}{2} + t + k_1$

For $t = 0$: $v = 0, k_1 = 0$

But $v = \frac{dx}{dt} = t^2 + t$

$\therefore$ $x = \frac{t^3}{3} + \frac{t^2}{2} + k_2$

For $t = 0$: we have $x = 0$, so $k_2 = 0$.

Therefore, $x = \frac{t^3}{2} + \frac{t^2}{2}$

For $t = 6$s: $x = 72 + 18 = 90$ m

[CHEMISTRY]

21. **(a)** $Na_2CO_3.xH_2O$. Its weight = 106 + 18 x.

Weight of anhydrous Na_2CO_3 = 106

% loss in weight = $\frac{18x \times 100}{106 + 18x} = 63$

$\therefore$ $x = 10.27 \approx 10$

22. **(c)** In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that Ratio of S and O when combine with C is 2 : 1. Ratio of S and O is SO_2 is 1 : 1

23. **(c)** Mol in each case

$7\,g\,N_2 = \frac{7}{28} = 0.25$; $2\,g\,H_2 = \frac{2}{2} = 1.0$;

$16\,g\,NO_2 = \frac{16}{46} = 0.34$; $16\,g\,O_2 = \frac{16}{32} = 0.50$

Thus hydrogen has maximum moles, hence maximum molecules.

24. **(a)** $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mE}}$

$= \frac{6.6\times10^{-34}}{\sqrt{2\times1\times0.5}} = 6.6\times10^{-34}$

25. **(b)** 1. $BO_3^{3-} \longrightarrow 5+8\times3+3=32$
$CO_3^- \longrightarrow 6+8\times3+2=32$
$NO_8^- \longrightarrow 7+8\times3+1=32$
} ISO electronic

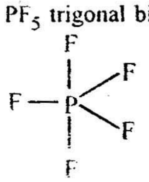
2.. $SO_3^- \longrightarrow 16+8\times3+2=42$
$CO_3^- \longrightarrow 32$
$NO_3^- \longrightarrow 32$
} not ISO electronic

3. $CN^- \longrightarrow 6+7+1=14$
$N_2 \longrightarrow 7\times2=14$
$C_2^- \longrightarrow 6\times2+2=14$
} ISO electronic

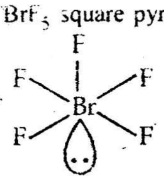
4. $PO_4^{3-} \longrightarrow 15\times8\times4+3=50$
$SO_4^- \longrightarrow 16+8+2=50$
$ClO_4^- \longrightarrow 17+8\times4+1=50$
} ISO electronic

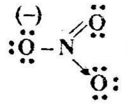
26. **(c)** $ns^2\,p^1$ is the electronic configuration of III period. Al_2O_3 is amphoteric oxide

27. **(c)** PF_5 trigonal bipyramidal



BrF_5 square pyramidal (distorted)



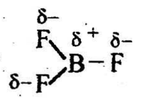
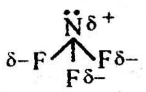
28. (d)  It has 4 bond pairs and none lone pair on N.

29. (d) The value of a is a measure of the magnitudeof the attractive forces between the molecules of the gas. Greater the value of 'a', larger is the attractive intermolecular force between the gas molecules.
The value of b related to the effective size of the gas molecules. It is also termed as excluded volume.
The gases with higher value of a and lower value of b are more liquefiable, hence for Cl_2 "a" should be greater than for C_2H_6 but for it b should be less than for C_2H_6.

30. (d) NH_3 and HCl react to form NH_4Cl

31. (b) This is combustion reaction, which is always exothermic hence
$\Delta H = -ve$
As the no. of gaseous molecules are increasing hence entropy increases
Now $\Delta G = \Delta H - T\Delta S$
For a spontaneous reaction
$\Delta G = -ve$
Which is possible in this case as $\Delta H = -ve$ and $\Delta S = +ve$.

32. (c) $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2,$
$\sigma 2p_z^2, \pi 2p_x^2, \pi 2p_y^2, \pi^* 2p_x^2, \pi^* 2p_y^2$
∴ No. of antibonding electron pairs = 4

33. (d) The shape of BF_3 is trigonal planar  and $\mu = 0$ hence it is non polar. The shape of NF_3 is pyramidal  and $\mu \neq 0$ hence it is polar.

34. 10% (w/w) solution means 100 g = $\frac{100}{1.1}$ ml
solution contains 10 g solute, NaOH

$$\text{Molarity} = \frac{w \times 1000}{m^1 \times v} = \frac{10 \times 1000}{40 \times \left(\frac{100}{1.1}\right)} = 2.75M$$

35. B

36. [a] The average energy per bond in O_2 is greater than that in O_3 because dissociation of O_2 is endothermic