WEEKLY TEST TYJ -1 TEST - 32 R
SOLUTION Date 22-12-2019

[PHYSICS]

1. (d)

2. (a) $\omega = \sqrt{\frac{\text{Acceleration}}{\text{Displacement}}} = \sqrt{\frac{2.0}{0.02}} = 10\,rad\,s^{-1}$

3. (b) From given equation $\omega = 3000$, $\Rightarrow n = \frac{\omega}{2\pi} = \frac{3000}{2\pi}$

4. (b)

5. (b) Given, $v = \pi\,cm/\sec$, $x = 1\,cm$ and $\omega = \pi s^{-1}$

using $v = \omega\sqrt{a^2 - x^2} \Rightarrow \pi = \pi\sqrt{a^2 - 1}$

$\Rightarrow 1 = a^2 - 1 \Rightarrow a = \sqrt{2}\,cm.$

6. (b) Length of the line = Distance between extreme positions of oscillation = 4 *cm*

So, Amplitude $a = 2\,cm.$

also $v_{max} = 12\,cm/s.$

$\because v_{max} = \omega a = \frac{2\pi}{T}a$

$\Rightarrow T = \frac{2\pi a}{v_{max}} = \frac{2 \times 3.14 \times 2}{12} = 1.047\sec$

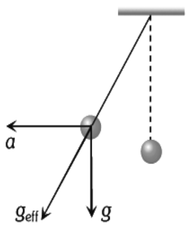
7. (c) $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T \propto \sqrt{l}$

8. (b) When a little mercury is drained off, the position of *c.g.* of ball falls (*w.r.t.* fixed and) so that effective length of pendulum increases hence *T* increase.

9. (b) Initially time period was $T = 2\pi\sqrt{\frac{l}{g}}$.

When train accelerates, the effective value of *g* becomes $\sqrt{(g^2 + a^2)}$ which is greater than *g*

Hence, new time period, becomes less than the initial time period.



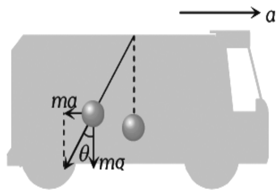
10. (b) As we know $g = \frac{GM}{R^2}$

$\Rightarrow \frac{g_{earth}}{g_{planet}} = \frac{M_e}{M_p} \times \frac{R_p^2}{R_e^2} \Rightarrow \frac{g_e}{g_p} = \frac{2}{1}$

Also $T \propto \frac{1}{\sqrt{g}} \Rightarrow \frac{T_e}{T_p} = \sqrt{\frac{g_p}{g_e}} \Rightarrow \frac{2}{T_p} = \sqrt{\frac{1}{2}}$

$\Rightarrow T_p = 2\sqrt{2}\sec$.

11. (b) In accelerated frame of reference, a fictitious force (pseudo force) *ma* acts on the bob of pendulum as shown in figure.



Hence,

$\tan\theta = \frac{ma}{mg} = \frac{a}{g}$

$\Rightarrow \theta = \tan^{-1}\left(\frac{a}{g}\right)$ in the backward direction.

12. (c) $T = 2\pi\sqrt{\frac{l}{g}}$ (Independent of mass)

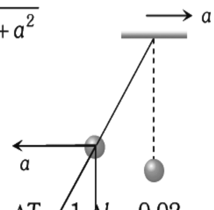
13. (c) In stationary lift $T = 2\pi\sqrt{\frac{l}{g}}$

In upward moving lift $T' = 2\pi\sqrt{\frac{l}{(g+a)}}$

(a = Acceleration of lift)

$\Rightarrow \frac{T'}{T} = \sqrt{\frac{g}{g+a}} = \sqrt{\frac{g}{\left(g + \frac{g}{4}\right)}} = \sqrt{\frac{4}{5}} \Rightarrow T' = \frac{2T}{\sqrt{5}}$

14. (d) $g' = \sqrt{g^2 + a^2}$



15. (d) $T \propto \sqrt{l} \Rightarrow \frac{\Delta T}{T} = \frac{1}{2}\frac{\Delta l}{l} = \frac{0.02}{2} = 0.01 \Rightarrow \Delta T = 0.01T$

Loss of time per day $= 0.01 \times 24 \times 60 \times 60$ $= 864\sec$

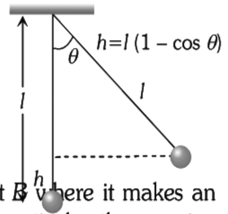
16. (b) At *B*, the velocity is maximum using conservation of mechanical energy

$\Delta PE = \Delta KE \Rightarrow mgH = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{2gH}$

17. (c) If suppose bob rises up to a height *h* as shown then after releasing potential energy at extreme position becomes kinetic energy of mean position

$\Rightarrow mgh = \frac{1}{2}mv_{max}^2 \Rightarrow v_{max} = \sqrt{2gh}$

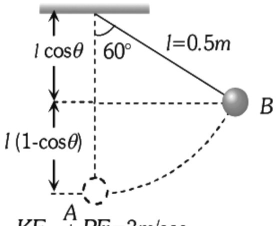
Also, from figure $\cos\theta = \frac{l-h}{l}$



$\Rightarrow h = l(1-\cos\theta)$

So, $v_{max} = \sqrt{2gl(1-\cos\theta)}$

18. (d) Let bob velocity be v at point B where it makes an angle of 60° with the vertical, then using conservation of mechanical energy



$KE_A + PE_A = KE_B + PE_B$

$\Rightarrow \frac{1}{2}m \times 3^2 = \frac{1}{2}mv^2 + mgl(1-\cos\theta)$

$\Rightarrow 9 = v^2 + 2 \times 10 \times 0.5 \times \frac{1}{2} \Rightarrow v = 2\, m/s$

19. (a) If initial length $l_1 = 100$ then $l_2 = 121$

By using $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{l_1}{l_2}}$

Hence, $\frac{T_1}{T_2} = \sqrt{\frac{100}{121}} \Rightarrow T_2 = 1.1T_1$

% increase $= \frac{T_2 - T_1}{T_1} \times 100 = 10\%$

20. (c) $T = 2\pi\sqrt{l/g} = 2\pi\sqrt{\frac{1}{\pi^2}} = 2\ sec$

[CHEMISTRY]

21. (a) $\underset{2}{PCl_5} \rightleftharpoons \underset{0}{PCl_3} + \underset{0}{Cl_2}$

$\frac{2\times 60}{100} \quad \frac{2\times 40}{100} \quad \frac{2\times 40}{100}$

Volume of container = 2 *litre*.

$K_c = \frac{\frac{2\times 40}{100\times 2}\times\frac{2\times 40}{100\times 2}}{\frac{2\times 60}{100\times 2}} = 0.266$.

22. (d) $\Delta n = 1$ for this change

So the equilibrium constant depends on the unit of concentration.

23. (c) $K = \frac{[NO_2]^2}{[N_2O_4]} = \frac{\left[2\times\frac{10^{-3}}{2}\right]^2}{\left[\frac{.2}{2}\right]} = \frac{10^{-6}}{10^{-1}} = 10^{-5}$.

24. (b) For $A + B \rightleftharpoons C + D$

$K = \frac{[C]\,[D]}{[A]\,[B]} = \frac{0.4\times 1}{0.5\times 0.8} = 1$.

25. (a) $K = \frac{[NH_3]^2}{[N_2]\,[H_2]^3}$

27. (d) $A + B \rightleftharpoons C + D$

$x \quad x \quad 0 \quad 0$

$2x \quad 2x$

$K_c = \frac{[C][D]}{[A][B]} = \frac{2x.2x}{x.x} = 4$

28. (d) $\underset{\substack{1\\(1-\alpha)}}{N_2O_4} \rightleftharpoons \underset{\substack{0\\2\alpha}}{2NO_2}$

total mole at equilibrium $= (1-\alpha) + 2\alpha = 1+\alpha$

29. (b) $K = \frac{[C_2H_6]}{[C_2H_4]\,[H_2]} = \frac{[mole/litre]}{[mole/litre]\,[mole/litre]}$

$=$ *litre/mole*. or litre $mole^{-1}$.

31. (b) $K_c = \frac{[HI]^2}{[H_2]\,[I_2]} = \frac{(28)^2}{8\times 3} = 32.66$

32. (a) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$; $\Delta n = 2 - 2 = 0$

33. (b) The rate of forward reaction is two times that of reverse reaction at a given temperature and identical concentration $K_{\text{equilibrium}}$ is 2 because the reaction is reversible. So $K = \frac{K_1}{K_2} = \frac{2}{1} = 2$.

35. (b) $K_c = \frac{K_f}{K_b} \therefore K_b = \frac{K_f}{K_c} = \frac{10^5}{100} = 10^3$

37. (d) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

For $1dm^3$ $R = k[SO_2]^2[O_2]$

$R = K\left[\frac{1}{T}\right]^2\left[\frac{1}{1}\right] = 1$

For $2dm^3$ $R = K\left[\frac{1}{2}\right]^2\left[\frac{1}{2}\right] = \frac{1}{8}$

So, the ratio is 8 : 1

38. (d) $K = \frac{[C][D]}{[A][B]} = \frac{\frac{1}{3}\times\frac{1}{3}}{\frac{2}{3}\times\frac{2}{3}} = \frac{1}{4} = 0.25$

So, $K = 0.25$

39. (d) $H_2 + I_2 \rightleftharpoons 2HI$

H_2: 0.4; $0.4 - 0.25 = 0.15$

I_2: 0.4; $0.4 - 0.25 = 0.15/2$

$2HI$: 0.50; 0.50/2

$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{\left[\frac{0.5}{2}\right]^2}{\left[\frac{0.15}{2}\right]\left[\frac{0.15}{2}\right]} = \frac{0.5\times 0.5}{0.15\times 0.15} = 11.11$

40. (c) The equilibrium constant does not change when concentration of reactant is changed as the concentration of product also get changed accordingly.

[MATHEMATICS]

1. (b) $\frac{d}{dx}\left[\log\sqrt{\frac{1-\cos x}{1+\cos x}}\right]=\frac{d}{dx}\left[\log\left(\tan\frac{x}{2}\right)\right]=\text{cosec}\,x$.

2. (a) Let $y=e^{x\sin x}\Rightarrow \log y=x\sin x$

$\therefore \frac{1}{y}\frac{dy}{dx}=\sin x+x\cos x$ or

$\frac{dy}{dx}=e^{x\sin x}(\sin x+x\cos x)$.

3. (b)

$\frac{d}{dx}\{\log(\sec x+\tan x)\}=\frac{\sec x\tan x+\sec^2 x}{\sec x+\tan x}=\sec x$.

4. (c) $\frac{d}{dx}\left(\frac{e^{ax}}{\sin(bx+c)}\right)$

$=\frac{ae^{ax}\sin(bx+c)-be^{ax}\cos(bx+c)}{\{\sin(bx+c)\}^2}$

$=\frac{e^{ax}[a\sin(bx+c)-b\cos(bx+c)]}{\sin^2(bx+c)}$.

5. (b) $\log y=\log 2+\frac{3}{2}\log(x-\sin x)-\frac{1}{2}\log x$

$\Rightarrow \frac{dy}{dx}=y\left[\frac{3}{2}.\frac{1-\cos x}{x-\sin x}-\frac{1}{2x}\right]$.

6. (d) $\frac{d}{dx}\log\left(\frac{e^x}{1+e^x}\right)=\frac{1+e^x}{e^x}\times\frac{d}{dx}\left(\frac{e^x}{1+e^x}\right)$

$=\frac{1+e^x}{e^x}\times\frac{e^x}{(1+e^x)^2}=\frac{1}{1+e^x}$.

7. (a) $\frac{d}{dx}[\log\sqrt{\sin\sqrt{e^x}}]=\frac{d}{dx}\left[\frac{1}{2}\log(\sin\sqrt{e^x})\right]$

$=\frac{1}{2}\cot\sqrt{e^x}\,\frac{1}{2\sqrt{e^x}}e^x=\frac{1}{4}e^{x/2}\cot(e^{x/2})$

8. (a) $\frac{d}{dx}[e^{ax}\cos(bx+c)]=$

$ae^{ax}\cos(bx+c)-be^{ax}\sin(bx+c)$

$=$

$e^{ax}[a\cos(bx+c)-b\sin(bx+c)]$.

9. (b) $y=\log_e\log_e x\Rightarrow e^y=\log_e x\Rightarrow e^y\frac{dy}{dx}=\frac{1}{x}$.

10. (c) $y=\frac{\log\tan x}{\log\sin x}$

$\Rightarrow \frac{dy}{dx}=\frac{(\log\sin x)\left(\frac{\sec^2 x}{\tan x}\right)-(\log\tan x)(\cot x)}{(\log\sin x)^2}$

$\Rightarrow \left(\frac{dy}{dx}\right)_{\pi/4}=\frac{-4}{\log 2}$ (On simplification).

11. (b) $\frac{d}{dx}(e^{x^3})=e^{x^3}.\frac{d}{dx}(x^3)=3x^2.e^{x^3}$.

12. (c) It is formula.

13. (c) $\frac{dy}{dx}=\frac{1}{\sqrt{1-x}}.\frac{d}{dx}(\sqrt{x})=\frac{1}{2\sqrt{x}.\sqrt{1-x}}$.

14. (b) We have $f(x)=3e^{x^2}$. Differentiating *w.r.t.* x, we get $f'(x)=6xe^{x^2}$; $\therefore f(0)=3$ and $f'(0)=0$

$\Rightarrow f'(x)-2xf(x)+\frac{1}{3}f(0)-f'(0)$

$=6xe^{x^2}-6xe^{x^2}+\frac{1}{3}(3)-0=1$

15. (a) $y=\log e^x+\frac{3}{4}\log\frac{x+2}{x-2}=x+\frac{3}{4}\log\frac{x+2}{x-2}$

$\Rightarrow y=x+\frac{3}{4}[\log(x+2)-\log(x-2)]$

$\Rightarrow \frac{dy}{dx}=1+\frac{3}{4}\left[\frac{1}{x+2}-\frac{1}{x-2}\right]=1-\frac{3}{x^2-4}$

$\Rightarrow \frac{dy}{dx}=\frac{x^2-7}{x^2-4}$.

16. (c) $\sqrt{x}+\sqrt{y}=1\Rightarrow\frac{dy}{dx}=-\frac{\sqrt{y}}{\sqrt{x}}\Rightarrow$

$\left(\frac{dy}{dx}\right)_{\left(\frac{1}{4},\frac{1}{4}\right)}=-1$.

17. (a) $y=e^{1+\log_e x}=e^1.e^{\log_e x}=e.x\Rightarrow\frac{dy}{dx}=e$.

18. (c) Differentiating $y=e^x\log x$, *w.r.t.* x ,we get

$\frac{dy}{dx}=e^x\times\frac{1}{x}+\log x\times e^x=e^x\left(\frac{1}{x}+\log x\right)$.

19. (c) $\frac{dy}{dx}=\frac{1}{2\sqrt{\sin\sqrt{x}}}\times\cos\sqrt{x}\times\frac{1}{2\sqrt{x}}$.

20. (b) Given $y=\log_{10}x^2$

$y=\frac{\log_e x^2}{\log_e 10}$, $\left(\because \log_a b=\frac{\log_e b}{\log_e a}\right)$

$y=\frac{2\log_e x}{\log_e 10}$, $\therefore\frac{dy}{dx}=\frac{2}{x\log_e 10}$.