AVIRAL
JEE | NEET | FOUNDATIONS

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

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

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

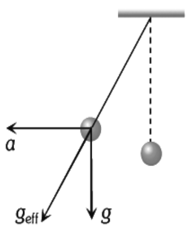
**7.** (c) $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T \propto \sqrt{l}$

**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.



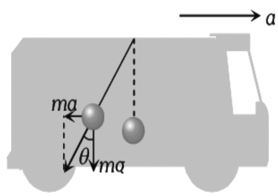

**10.** (b) As we know $g = \frac{GM}{R^2}$

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

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)

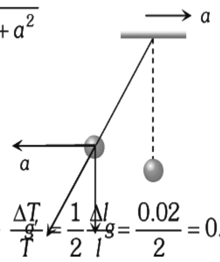
**13.** (c) In stationary lift $T = 2\pi\sqrt{\frac{l}{g}}$

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 $= 0.01 \times 24 \times 60 \times 60$
$= 864 \sec$

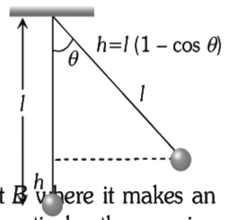
**16.** (b) At $B$, the velocity is maximum using conservation of mechanical energy

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

**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

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

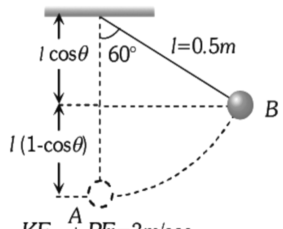
Also, from figure $\cos\theta = \frac{l-h}{l}$




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

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

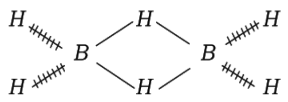
Hence, $\frac{T_1}{T_2} = \sqrt{\frac{100}{121}} \Rightarrow T_2 = 1.1T_1$

% 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]

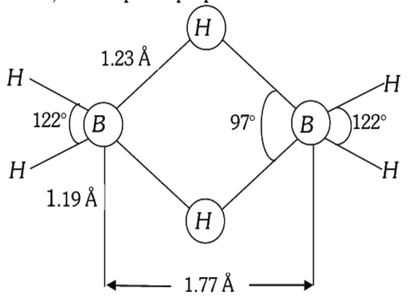
**24.** (d) $B_2H_6$ has two types of $B-H$ bonds



$B \underset{119\,pm}{} H$ (Terminal bond)

$B \underset{134\,pm}{} H$ (Bridge bond)

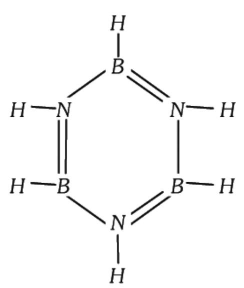
**25.** (b) Dilthey in 1921 proposed a bridge structure for diborane. Four hydrogen atoms, two on the left and two on the right, known as terminal hydrogens and two boron atoms lie in the same plane. Two hydrogen atoms forming bridges, one above and other below, lie in a plane perpendicular to the rest of molecule.



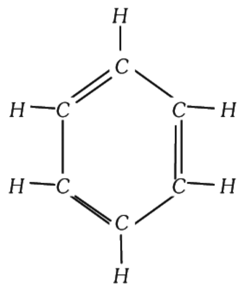

**27.** (c) $2H_3BO_3 \rightarrow B_2O_3 + 3H_2O$.

**28.** (a,c,d) $Al_2Cl_6$, $In_2Cl_6$, $Ga_2Cl_6$

**29.** (a) Borazine $B_3N_3H_6$, is isoelectronic to benzene and hence, is called inorganic benzene some physical properties of benzene and borazine are also similar.



**Borazine**



**Benzene**

**30.** (c) Except $B(OH)_3$ all other hydroxide are of metallic hydroxide having the basic nature $B(OH)_3$ are the hydroxide of nonmetal showing the acidic nature.

**31.** (d) Boron form different hydride of general formula $B_nH_{n+4}$ and $B_nH_{n+6}$ but $BH_3$ is unknown.

**32.** (c) Alumina is amphoteric oxide, which reacts acid as well as base.

**33.** (d) Amphoteric substance can react with both acid and base.

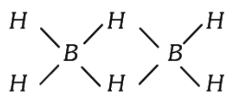
**34.** (d) $2KOH + 2Al + 2H_2O \rightarrow 2KAlO_2 + 3H_2$

**36.** (c) $B(OH)_3 \Rightarrow H_3BO_3$ Boric acid

$Al(OH)_3 \Rightarrow$ Amphoteric

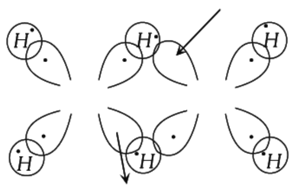
**37.** (b) $Al_2O_3$ is an amphoteric oxide.

**38.** (a)



$3c-2e : B-H-B$;   $2c-2e : H-B-H$

**39.** (a) $B_2H_6$



**40.** (a) Concentration of Lewis acid of boron tri halides is increased in following order. $BF_3 < BCl_3 < BBr_3 < BI_3$.

## [MATHEMATICS]

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

**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 $y=\log_{10}x^2$

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

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