WEEKLY TEST TYJ TEST - 32 B
SOLUTION Date 22-12-2019

[PHYSICS]

1. (d) $v = n\lambda \Rightarrow \lambda = \frac{v}{n} = \frac{330}{256} = 1.29m$

2. (a) $v_{max} = a\omega = a \times 2\pi n = 0.1 \times 2\pi \times 300 = 60\pi\ cm/sec$

3. (a)

4. (c) Velocity of sound in gas $v = \sqrt{\frac{\gamma RT}{M}} \Rightarrow$

$v \propto \sqrt{\frac{\gamma T}{M}}$

$\Rightarrow \frac{v_{N_2}}{v_{He}} = \sqrt{\frac{\gamma_{N_2}}{\gamma_{He}} \times \frac{M_{He}}{M_{H_2}}} = \sqrt{\frac{\frac{7}{5}R \times 4}{\frac{5}{3}R \times 28}} = \frac{\sqrt{3}}{5}$

5. (b) Wave number is the reciprocal of wavelength and is written as $\bar{n} = \frac{1}{\lambda}$.

6. (c) $\lambda = \frac{v}{n} = \frac{340}{200} = 1.7\ m$

7. (b)

8. (d) $v \propto \lambda \Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{2/3}{3/10} = \frac{20}{9}$

9. (b) When medium changes, velocity and wavelength changes but frequency remains constant.

10. (b) $t = \sqrt{\frac{2h}{g}} + \frac{h}{v} = \sqrt{\frac{2 \times 19.6}{9.8}} + \frac{19.6}{v} = 2.06$

$\Rightarrow v = 326.7\ m/s$

11. (b) $v \propto \sqrt{T} \Rightarrow \frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} \Rightarrow 2 = \sqrt{\frac{T_2}{(273+0)}}$

$\Rightarrow T_2 = 273 \times 4 = 1092K = 819^oC$

12. (d) Velocity of sound in steel is maximum out of the given materials water and air. In vacuum sound cannot travel, it's speed is zero.

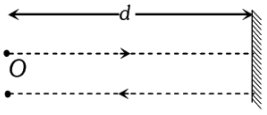
13. b) Distance between a compression and the nearest rarefaction is $\frac{\lambda}{2} = 1m$. Hence $n = \frac{v}{\lambda} = \frac{360}{2} = 180\,Hz$.

14. (a) $v = \sqrt{\frac{\gamma P}{\rho}} \Rightarrow \frac{v_{O_2}}{v_{H_2}} = \sqrt{\frac{\rho_{H_2}}{\rho_{o_2}}} = \sqrt{\frac{1}{16}} = \frac{1}{4}$

15. (c) Path difference $\Delta = \frac{\lambda}{2\pi} \times \phi \Rightarrow 1 = \frac{\lambda}{2\pi} \times \frac{\pi}{2} \Rightarrow \lambda = 4m$

Hence $v = n\lambda = 120 \times 4 = 480\ m/s$

16. (a) Suppose the distance between shooter and reflecting surface is d. Hence time interval for hearing echo is



$t = \frac{2d}{v} \Rightarrow 8 = \frac{2d}{350} \Rightarrow d = 1400\,m$.

17. (b) Speed of sound in gases is given by

$v = \sqrt{\frac{\gamma RT}{M}} \Rightarrow v \propto \frac{1}{\sqrt{M}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{m_2}{m_1}}$

18. (a) Speed of sound $v = \sqrt{\frac{\gamma P}{d}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{d_2}{d_1}}$ ($\because P$ - constant)

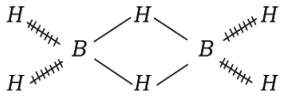
19. (c) At given temperature and pressure

$v \propto \frac{1}{\sqrt{\rho}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{\rho_2}{\rho_1}} = \sqrt{\frac{4}{1}} = 2:1$

20. (b) $v \propto \frac{1}{\sqrt{M}} \Rightarrow \frac{v_{H_2}}{v_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{H_2}}} = \sqrt{\frac{32}{2}} \Rightarrow \frac{v_{H_2}}{v_{O_2}} = \frac{4}{1}$

[CHEMISTRY]

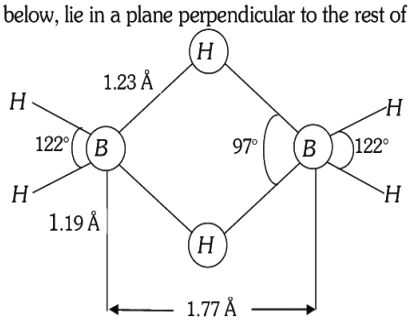
24. (d) B_2H_6 has two types of $B-H$ bonds



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

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

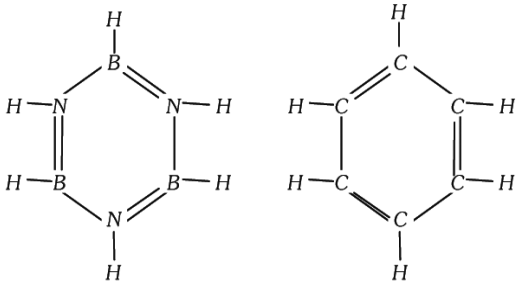
25. (b) Dilthey in 1921 proposed a bridge structure for diborane. Four hydrogen atoms, two on the left and two on the right, known as terminal hydrogens and two boron atoms lie in the same plane. Two hydrogen atoms forming bridges, one above and other below, lie in a plane perpendicular to the rest of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

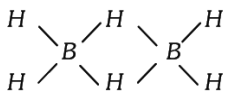
34. (d) $2KOH + 2Al + 2H_2O \rightarrow 2KAlO_2 + 3H_2$

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

$Al(OH)_3 \Rightarrow$ Amphoteric

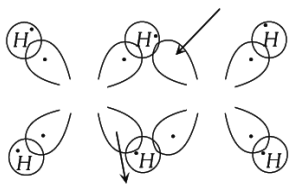
37. (b) Al_2O_3 is an amphoteric oxide.

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

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

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

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