SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC | **EAMCET DPP** | **Date: 25-04-2020**

Time: 3 Hours | **Max. Marks: 80 M**

MATHEMATICS-A

1. **If '$\bar{a}$ a' is any vector, then $\left(\bar{a}\times\bar{i}\right)^2+\left(\bar{a}\times\bar{j}\right)^2+\left(\bar{a}\times\bar{k}\right)^2$ is equal to**

1) $|\bar{a}|^2$ 2) 0 3) $3|\bar{a}|^2$ 4) $2|\bar{a}|^2$

2. **The unit vector perpendicular to the vector $6\bar{i}+2\bar{j}+3\bar{k}$ and $3\bar{i}-6\bar{j}-2\bar{k}$ is**

1) $\dfrac{2\bar{i}-3\bar{j}+6\bar{k}}{7}$ 2) $\dfrac{2\bar{i}-3\bar{j}-6\bar{k}}{7}$ 3) $\dfrac{2\bar{i}+3\bar{j}-6\bar{k}}{7}$ 4) $\dfrac{2\bar{i}+3\bar{j}+6\bar{k}}{7}$

3. **If $\bar{a}=\bar{i}+\bar{j}+\bar{k}$ and $\bar{b}=\bar{i}-2\bar{j}+\bar{k}$, then the vector $\bar{c}$ such that $\bar{a}.\bar{c}=2$ and $\bar{a}\times\bar{c}=\bar{b}$ is**

1) $\frac{1}{3}\left(\bar{i}-2\bar{j}+\bar{k}\right)$ 2) $\frac{1}{3}\left(-\bar{i}+2\bar{j}+5\bar{k}\right)$ 3) $\frac{1}{3}\left(\bar{i}+2\bar{j}-5\bar{k}\right)$ 4) $\frac{1}{3}\left(-\bar{i}+2\bar{j}-5\bar{k}\right)$

4. **If $\bar{a}+\bar{b}+\bar{c}=0$ then which relation is correct**

1) $\bar{a}=\bar{b}=\bar{c}=0$ 2) $\bar{a}.\bar{b}=\bar{b}.\bar{c}=\bar{c}.\bar{a}$ 3) $\bar{a}\times\bar{b}=\bar{b}\times\bar{c}=\bar{c}\times\bar{a}$ 4) None of these

5. **If $\bar{a}=2\bar{i}+3\bar{j}-5\bar{k}$, $\bar{b}=m\bar{i}+n\bar{j}+12\bar{k}$ and $\bar{a}\times\bar{b}=0$ then $(m,n)=0$**

1) $\left(-\frac{24}{5},\frac{36}{5}\right)$ 2) $\left(\frac{24}{5},-\frac{36}{5}\right)$ 3) $\left(-\frac{24}{5},-\frac{36}{5}\right)$ 4) $\left(\frac{24}{5},\frac{36}{5}\right)$

6. **Let $\bar{a},\bar{b},\bar{c}$ be three vectors such that $a\neq 0$, and $\bar{a}\times\bar{b}=2\bar{a}\times\bar{c}$, $|\bar{a}|=|\bar{c}|=1$, $|\bar{b}|=4$ and $|\bar{b}\times\bar{c}|=\sqrt{15}$. If $\bar{b}-2\bar{c}=\lambda\bar{a}$, then λ equal to**

1) 1 2) ± 4 3) 3 4) -2

7. **A force of magnitude 6 acts along the vector $(9,6,-2)$ and passes through a point $A(4,-1,-7)$. The moment of the force about the point $O(1,-3,2)$ is**

1) $\frac{150}{11}\left(2\bar{i}-3\bar{j}\right)$ 2) $\frac{6}{11}\left(50\bar{i}-75\bar{j}+36\bar{k}\right)$

3) $150\left(2\bar{i}-3\bar{j}\right)$ 4) $6\left(50\bar{i}-75\bar{j}+36\bar{k}\right)$

8. **If $\bar{a}=\bar{i}-\bar{j}$, $\bar{b}=\bar{i}\times\bar{j}$, $\bar{c}=\bar{i}+3\bar{j}+5\bar{k}$ and $\bar{n}$ is a unit vector such that $\bar{b}.\bar{n}=0$, $\bar{a}.\bar{n}=0$ then the value of $|\bar{c}.\bar{n}|$ is equal to**

1) 1 2) 3 3) 5 4) 2

9. **If $a=(1,-1,1)$ and $c=(-1,-1,0)$ then vector b satisfying $a\times b=c$ and $a.b=1$ is**

1) $(1,0,0)$ 2) $(0,0,1)$ 3) $(0,-1,0)$ 4) none of these

10. **The position vectors of the points A, B, C are $\bar{i}+\bar{j}$, $\bar{j}+\bar{k}$ and $\bar{k}+\bar{i}$ respectively. The vector area of the $\Delta ABC=\pm\frac{1}{2}\bar{\alpha}$ where $\bar{\alpha}$ =**

1) $-\bar{i}+\bar{j}+\bar{k}$ 2) $\bar{i}-\bar{j}+\bar{k}$ 3) $\bar{i}+\bar{j}-\bar{k}$ 4) $\bar{i}+\bar{j}+\bar{k}$

11. **A tetrahedron has vertices P(1, 2, 1) and Q(2, 1, 3), R(-1, 1, 2) and O(0, 0,0) the angle between the faces OPQ and PQR is**

1) $\cos^{-1}\left(\frac{19}{35}\right)$ 2) $\cos^{-1}\left(\frac{7}{31}\right)$ 3) $\cos^{-1}\left(\frac{17}{31}\right)$ 4) $\cos^{-1}\left(\frac{9}{35}\right)$

12. **The area (in sq.units) of the parallelogram whose diagonals are along the vectors $8\bar{i}-6\bar{j}$ and $3\bar{i}+4\bar{j}-12\bar{k}$ is**

1) 65 2) 52 3) 26 4) 20

13. **The vectors c,** $a = x\overline{i} + y\overline{j} + 2\overline{k}$ **and** $\overline{b} = \overline{j}$ **are such that** a, c, b **form a right handed system, then c is**

1) $z\overline{i} - x\overline{k}$ **2) 0** **3)** $y\overline{j}$ **4)** $-z\overline{i} + x\overline{k}$

14. **If** $\overline{a}$ **and** $\overline{b}$ **are unit vectors such that** $\overline{a} \times \overline{b}$ **is also a unit vector, then the angle between** $\overline{a}$ **and** $\overline{b}$ **is**

1) 0 **2)** $\frac{\pi}{3}$ **3)** $\frac{\pi}{2}$ **4)** π

15. **If** $\overline{a} \times \overline{b} = \overline{b} \times \overline{c} \neq 0$**, where** $\overline{a}, \overline{b}$ *and* $\overline{c}$ **are coplanar vectors, then for some scalar K**

1) $\overline{a} + \overline{c} = K\overline{b}$ **2)** $\overline{a} + \overline{b} = K\overline{c}$ **3)** $\overline{b} + \overline{c} = K\overline{a}$ **4) none of these**

16. **If** $|a| = 2, |b| = 5$ **and** $|a \times b| = 8$**, then a.b is equal to**

1) 0 **2) 2** **3) 4** **4) 6**

17. **If** $|\overline{c}|^2 = 60$ **and** $\overline{c} \times \left(\overline{i} + 2\overline{j} + 5\overline{k}\right) = 0$ **then a value of** $\overline{c}.\left(-7\overline{i} + 2\overline{j} + 3\overline{k}\right)$ **is**

1) $4\sqrt{2}$ **2) 12** **3) 24** **4)** $12\sqrt{2}$

18. **If** $\overline{a}, \overline{b}$ **and** $\overline{c}$ **are unit vectors such that** $\overline{a} + \overline{b} + \overline{c} = 0$ **and** $\left(\overline{a}, \overline{b}\right) = \frac{\pi}{3}$**, then**

$|\overline{a} \times \overline{b}| + |\overline{b} \times \overline{c}| + |\overline{c} \times \overline{a}| =$

1) $\frac{3}{2}$ **2) 0** **3)** $\frac{3\sqrt{3}}{2}$ **4) 3**

19. **Let** $\overline{a} = 3\overline{i} + 2\overline{j} + x\overline{k}$ **and** $\overline{b} = \overline{i} - \overline{j} + \overline{k}$ **for some real x, Then** $|\overline{a} \times \overline{b}| = r$ **is possible if**

1) $r \geq 5\frac{\sqrt{3}}{2}$ **2)** $3\sqrt{\frac{3}{2}} < r < 5.\sqrt{\frac{3}{2}}$ **3)** $\sqrt{\frac{3}{2}} < r < 3.\sqrt{\frac{3}{2}}$ **4)** $0 < r \leq \sqrt{\frac{3}{2}}$

20. **Let** $\overline{a} = 3\overline{i} + 2\overline{j} + 2\overline{k}$ **and** $\overline{b} = \overline{i} + 2\overline{j} - 2\overline{k}$ **be two vectors, if a vector perpendicular to both the vectors** $\overline{a} + \overline{b}$ **and** $\overline{a} - \overline{b}$ **has the magnitude 12 then one such vector is**

1) $4\left(2\overline{i} + 2\overline{j} + \overline{k}\right)$ **2)** $4\left(2\overline{i} - 2\overline{j} - \overline{k}\right)$ **3)** $4\left(2\overline{i} + 2\overline{j} - \overline{k}\right)$ **4)** $4\left(-2\overline{i} - 2\overline{j} + \overline{k}\right)$

MATHEMATICS-B

21. **If the function** $f(x) = kx^3 - 9x^2 + 6x + 3$ **is increasing** $\forall x \in R$ **then** $k \in$

1) $(-\infty, 0)$ **2)** $\left(-\infty, \frac{9}{2}\right)$ **3)** $\left(\frac{9}{2}, \infty\right)$ **4)** $(3, 4)$

22. $f(x) = x^{\frac{1}{x}}$ **is increasing when**

1) $x > e$ **2)** $x < e$ **3)** $-e < x < e$ **4)** $0 < x < e$

23. **If** $f(x) = \int_0^x e^t (t-1)(t-2) dt$, **then f is decreases in the interval**

1) $(-\infty, -2)$ **2)** $(-2, -1)$ **3) (1, 2)** **4)** $(2, \infty)$

24. **The function** $f(x) = \sin^4 x + \cos^4 x$ **increases if**

1) $0 < x < \frac{\pi}{8}$ **2)** $\frac{\pi}{4} < x < \frac{3\pi}{8}$ **3)** $\frac{3\pi}{8} < x < \frac{5\pi}{8}$ **4)** $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

25. **If** $f(x) = x^3 + ax^2 + bx + 5\sin^2 x$ **be an increasing on R then**

1) $a^2 + 3b + 15 < 0$ **2)** $a^2 + 3b + 15 > 0$ **3)** $a^2 - 3b + 15 < 0$ **4)** $a^2 - 3b + 15 > 0$

26. **Define** $f(x)=\frac{1}{2}[|\sin x|+\sin x], 0<x\le 2\pi$ **, then f is**

1) increasing in $\left(\frac{\pi}{2},\frac{3\pi}{2}\right)$

2) decreasing in $\left(0,\frac{\pi}{2}\right)$ **and increasing in** $\left(\frac{\pi}{2},\pi\right)$

3) increasing in $\left(0,\frac{\pi}{2}\right)$ **and decreasing** $\left(\frac{\pi}{2},\pi\right)$

4) increasing in $\left(0,\frac{\pi}{4}\right)$ **and decreasing in** $\left(\frac{\pi}{4},\pi\right)$

27. $f(x)=\cos^{-1}x$ **is decreasing in**

1) $(-1,0)$ **2)** $\left(0,\frac{\pi}{2}\right)$ **3)** $(-1,1)$ **4)** $(0,1)$

28. **The increasing function in** $\left(0,\frac{\pi}{4}\right)$ **is**

1) $\cos x+\sin x$ **2)** $\cos x-\sin x$ **3)** $\frac{\sin x}{x}$ **4)** $\frac{x}{\sin x}$

29. **If a, b, c be real, then** $f(x)=\begin{vmatrix} x+a^2 & ab & ac \\ ab & x+b^2 & bc \\ ac & bc & x+c^2 \end{vmatrix}$ **is decreasing on**

1) $\left(-\frac{2}{3}(a^2+b^2+c^2),0\right)$ **2)** $\left(0,\frac{2}{3}(a^2+b^2+c^2)\right)$

3) $\left(\frac{a^2+b^2+c^2}{3},0\right)$ **4)** $\left(0,\frac{a^2+b^2+c^2}{3}\right)$

30. **If** $\log(1+x)-\frac{2x}{2+x}$ **is increasing, then**

1) $0<x<\infty$ **2)** $-\infty<x<0$ **3)** $-\infty<x<\infty$ **4)** $1<x<2$

31. **The quadratic equation** $3ax^2+2bx+c=0$ **has at least one root between 0 and 1, if**

1) $a+b+c=0$ **2) c = 0** **3)** $3a+2b+c=0$ **4)** $a+b=c$

32. **The value of c in Lagranes theorem for** $f(x)=\log x^n\,[1,e]$ **is**

1) $\frac{e}{2}$ **2) e – 1** **3) e – 2** **4) 1 – e**

33. **For the function** $f(x)=x^3-6x^2+ax+b$ **if Rolle's theorem holds on [1, 3] with** $c=2+\frac{1}{\sqrt{3}}$ **then (a, b) =**

1) (11, 12) **2) (11, 11)** **3) (11, any value)** **4) (any values 0)**

34. **If** $f(x)$ **satisfies Rolle's theorem on** $\{a,b\}$ **then** $\int_a^b f'(x)dx=$

1) $f(b)-f(a)$ **2)** $f(a)$ **3)** $f(b)$ **4) 0**

35. **The value of c in Lagranges theorem for** $f(x)=x(x-2)^2$ **in [0, 2] is**

1) 0 **2) 2** **3)** $\frac{2}{3}$ **4)** $\frac{3}{2}$

36. **The value of c in Lagranges mean value theorem for** $f(x)=(x-a)^m(x-b)^n$ **in [a, b] is**

1) $\frac{mb+na}{m+n}$ **2)** $\frac{ma+nb}{m+n}$ **3)** $\frac{a+b}{m+n}$ **4)** $\frac{a+b}{2}$

37. The constant c of Lagranges mean value theorem for $f(x)=2\sin x+\sin 2x$ **in** $[0,\pi]$ **is**

1) $\frac{\pi}{6}$ **2)** $\frac{\pi}{4}$ **3)** $\frac{\pi}{3}$ **4)** $\frac{\pi}{2}$

38. If f and g are differentiable functions in $[0,1]$ **satisfying** $f(0)=2=g(1)$**,** $g(0)=O$ **and** $f(1)=6$ **then the for some** $c\in(0,1)$**.**

1) $f'(c)=g'(c)$ **2)** $f'(c)=2g'(c)$ **3)** $2f'(c)=g'(c)$ **4)** $2f'(c)=3g'(c)$

39. If the Rolle's theorem holds for the function $f(x)=2x^3+ax^2+bx$ **in** $[-1,1]$ **for the point** $c=\frac{1}{2}$ **then the value of** $2a+b$

1) 1 2) -1 3) 2 4) -2

40. The constant θ **of Lagranges theorem for** $f(x)=x^2-2x+3$ **in** $\left[1,\frac{3}{2}\right]$ **is**

1) $\frac{1}{2}$ **2)** $\frac{1}{3}$ **3)** $\frac{1}{4}$ **4)** $\frac{1}{6}$

PHYSICS

41. A boy weighing 42kg eats bananas whose energy is 980 calories. If this energy is used to go to height 'h' find the value of 'h' (J = 42 J/calorie)

1) 10m 2) 20m 3) 40m 4) 50m

42. When 1g of water at 100^{0}C is converted into steam at 100^{0}C, it occupies a volume of 1671cc at normal atmospheric pressure. Find the increase in internal energy of the molecules of steam

1) 5098.8J 2) 2098.8J 3) 2000J 4) 2.098J

43. Five kg of air is heated at constant volume. The temperature of air increases from 300K to 340K. If the specific heat at constant volume is 0.169kcal/kg K . Find the amount of heat absorbed

1) 3.38 kcal 2) 4.38 kcal 3) 33.8 kcal 4) 338 kcal

44. A gas undergoes a change of state during which 100J of heat is supplied to it and it does 20J of work. The system is brought back to its original state through a process during which 20J of heat is released by the gas. What is the work done by the gas in the second process

1) +60J 2) -60J 3) +80J 4) -80J

45. In a cyclic process, an ideal gas is adiabatically taken from B to A, the workdone on the gas during the process $B\rightarrow A$ **is 30J, when the gas is taken from** $A\rightarrow B$ **the heat absorbed by the gas is 20J. What is the change in internal energy of the gas in the process** $A\rightarrow B$

1) -30J 2) +30J 3) 60J 4) 80J

46. During an adiabatic process if the pressure of an ideal gas is proposonal to the cube of its temperature, find r.

1) $\frac{1}{2}$ **2)** $\frac{3}{2}$ **3)** $\frac{4}{3}$ **4)** $\frac{5}{3}$

47. P-V diagram of a diatomic gas is a straight line passing through origin. What is the molar heat capacity of the gas in the process

1) 2R 2) 3R 3) 4R 4) R

48. Efficiency of a heat engine whose sink is at temperature of 300k is 40%. To increase the efficiency to 60%, keeping the sink temp constant, the source temperature must increased by

1) 273K 2) 200K 3) 220K 4) 250K

49. The temperature of an object is observed to rise in a period. During this period

1) Heat must be supplied to it
2) Heat may have been supplied to it
3) Work may have been done to it
4) 2 or 3

50. **For isothermal change $\frac{\Delta p}{p}$ is equal to**

1) $\frac{1}{2}r\frac{\Delta v}{v}$ **2)** $-\frac{\Delta v}{v}$ **3)** $-r\frac{\Delta v}{v}$ **4)** $-r^2\frac{\Delta v}{v}$

51. **Find the molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of Q is supplied to it**

1) $\frac{10}{3}R$ **2) 10R** **3)** $\frac{3}{10}R$ **4) 3R**

52. **A carnot's cycle operating between $T_1 = 500K$ and $T_2 = 300K$ producing 1KJ of mechanical work per cycle. Find the heat transferred to the engine by the reservoirs**

1) 500J **2) 1000J** **3) 1500J** **4) 2000J**

53. **Two spheres A and B with masses in the ratio 2 : 3 and specific heat 2 : 3 fall freely from rest. If the rise in their temperatures on reaching the ground are in the ratio 1 : 2. The ratio of their heights of fall is**

1) 3 : 1 **2) 1 : 3** **3) 4 : 3** **4) 3 : 4**

54. **Air expands from 5 litres to 10 litres at 2atm pressure. External workdone is**

1) 10J **2) 1000J** **3) 3000J** **4) 300J**

55. **One mole of ideal gas expands isothermally to double its volume at 27^0C. Then the workdone by the gas is nearly**

1) 415 cal **2) 450 cal** **3) 400 cal** **4) 385 cal**

56. **Two identical balls 'A' and 'B' are moving with same velocity. If velocity of 'A' is reduced to half and of 'B' is zero, then the rise in temperature of 'A' to that of 'B' is**

1) $\frac{1}{2}$ **2)** $\frac{1}{4}$ **3)** $\frac{3}{4}$ **4)** $\frac{5}{4}$

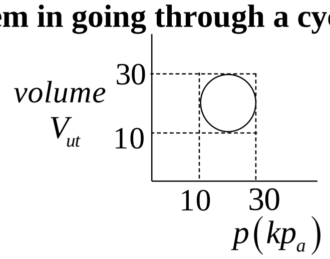
57. **An ideal refrigerator has a freezer at a temperature of -13^0C. The coefficient of performance of the engine is 5, the temperature of the air (to which heat is rejecting will be)**

1) 19^0C **2) 29^0C** **3) 39^0C** **4) 49^0C**

58. **The volume of air increased by 5% in its adiabatic expansion. The percentage decrease in its pressure will be**

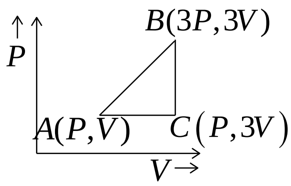
1) 7% **2) 5%** **3) 4%** **4) 10%**

59. **Heat energy absorbed by a system in going through a cyclic process shown in fig. is**



1) $10^7\pi J$ **2)** $10^4\pi J$ **3)** $10^2\pi J$ **4)** $10^{-3}\pi J$

60. **An ideal gas is taken around ABCA as shown in the above diagram. The work during a cycle is**



1) 2PV **2) PV** **3)** $\frac{1}{2PV}$ **4) zero**

CHEMISTRY

61. Reaction of ROH with $RMgx$ produces

1) RH 2) $R-H$ 3) $R-R$ 4) $R-R$

62. The increasing order of reduction of alkyl halides with Zn and dilute HCl is

1) $R-Cl<R-I<R-Br$ 2) $R-Cl<R-Br<R-I$

3) $R-I<R-Br<R-Cl$ 4) $R-Br<R-I<R-Cl$

63. Sodium acetate can be converted to ethane the following method

1) Wurtz reaction 2) Kolbe's electrolysis

3) Decarboxylation in presence of soda lime 4) Hydrogenation

64. In Wurtz reaction in the preparation of Alkenes metallic sodium act as

1) Oxidising agent 2) Reducing agent 3) Dehydrogenating agent

4) Dehydro halogenating agent

65. The dihedral angle between the hydrogen atoms of 2-methyl groups in staggered conformation of ethan is

1) 0^0 2) 60^0 3) 120^0 4) 240^0

66. Ethyl bromide (or) chloride can be converted to butane in the presence of

1) $LiAlH_4$ 2) $Na/Dry\ ether$ 3) $alc.KOH$ 4) aq.KOH

67. The ratio of products 1-chloropropane to 2-chloropropane respectively formed in the chlorination of propane if all the hydrogens are abstracted at equal rates is

1) 50 : 50 2) 25 : 75 3) 75 : 25 4) 12.5 : 87.5

68. Of the five isomeric hexanes, the isomer which can give two monochlorinated compound is

1) n-hexane 2) 2, 3-dimethyl butane

3) 2,2 – dimethyl butane 4) 2-methyl pentane

69. In the complete combustion of ethane the number of oxygen molecules required is

1) 7 2) 5 3) 7/2 4) 5/2

70. $Al_4C_3 \xrightarrow{Hydrolysis} A \xrightarrow[HNO_3]{400^0-475^0C} B$**, A and B are**

1) C_2H_2 and $C_2H_3NO_2$ 2) $CH_4\ and\ CH_3NO_2$

3) $CH_4\ and\ CH_3NO_3$ 4) $C_2H_2\ and\ CH_3CN$

71. The olefin which on Ozonolysis gives CH_3CH_2CHO and CH_2CHO is

1) 1 – butane 2) 2-butene 3) 1-pentene 4) 2-pentene

72. When propynodide is heated with Alc.KOH, the product is

1) propene 2) Cyclopropane 3) propyne 4) propane

73. Identify A and B . In the following reaction $C_2H_4+HBr \rightarrow A \xrightarrow{Na,ether} B$,

1) C_2H_5Br, C_4H_{10} 2) C_2H_6, C_2H_5OH 3) C_3H_8, C_2H_5OH 4) C_2H_2, C_2H_5OH

74. Addition of oxygen on ethylene in presence of Ag at 200^0C forms

1) Epoxy ethane 2) Oxiranes 3) Cyclic ethers 4) All

75. The bonds present between two carbon atoms in ethylene are

1) $3\sigma\ and\ 1\pi\ bond$ 2) $1\sigma\ and\ 1\pi\ bond$ 3) $1\pi\ and\ 3\sigma\ bond$ 4) $1\pi\ and\ 5\sigma\ bond$

76. On ozonolysis one mole of hydrocarbon yields two moles of formaldehyde. The hydrocarbon is

1) But-2-ene 2) Ethylene 3) Propylene 4) Acetylene

77. Ethylene gives epoxy ethane on oxidation with

1) $KmnO_4/OH$ 2) $K_2Cr_2O_2/H^+$ 3) $Ag_2O/200^0C$ 4) $H_2SO_4/170^0C$

78. In the following sequence of reaction the compound 'A' is

$A \xrightarrow{HBr} B \xrightarrow{Alc.KOH} C \xrightarrow{O_2.Zn/H_2O} CH_3CHO + HCHO$

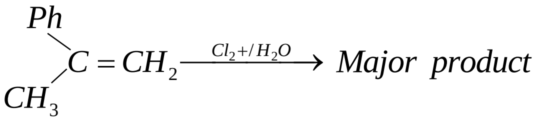
1) Ethylene 2) Acetic acid 3) propene 4) 1-butene

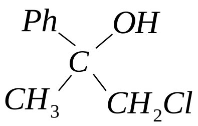
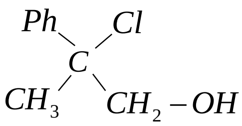
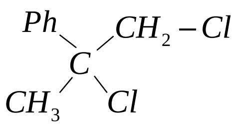
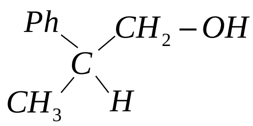
79. **Carbon atom shows** $sp^2 - hybridisation$ **in compounds A and B. A decolourises alkaline potassium permanganate solution where as B cannot decolourise the solution then A and B are**

1) propene and ethene | **2) ethene and Benzene**

3) Benzene and ethene | **4) propene and ethene**

80.



1) 
2) 
3) 
4) 

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KEY SHEET

MATHEMATICS-A

1) **4**	2) **3**	3) **2**	4) **3**	5) **3**	6) **2**	7) **1**	8) **3**	9) **2**	10) **4**
11) **1**	12) **1**	13) **1**	14) **3**	15) **1**	16) **4**	17) **4**	18) **3**	19) **1**	20) **2**

MATHEMATICS-B

1) **3**	2) **4**	3) **3**	4) **2**	5) **3**	6) **3**	7) **3**	8) **1**	9) **1**	10) **1**
11) **1**	12) **2**	13) **3**	14) **4**	15) **3**	16) **1**	17) **3**	18) **2**	19) **2**	20) **1**

PHYSICS

21) **1**	22) **2**	23) **3**	24) **1**	25) **1**	26) **2**	27) **2**	28) **4**	29) **4**	30) **2**
31) **1**	32) **3**	33) **2**	34) **2**	35) **1**	36) **3**	37) **3**	38) **1**	39) **3**	40) **1**

CHEMISTRY

61) **2**	62) **2**	63) **2**	64) **2**	65) **2**	66) **2**	67) **3**	68) **2**	69) **3**	70) **2**
71) **4**	72) **1**	73) **1**	74) **2**	75) **4**	76) **2**	77) **2**	78) **3**	79) **2**	80) **1**

HINTS & SOLUTIONS

MATHEMATICS

1sol. Let $\bar{a}=a_1\bar{i}+a_2\bar{j}+a_3\bar{k}$

$\therefore \bar{a}\times\bar{i}=\left(a_1\bar{i}+a_2\bar{j}+a_3\bar{k}\right)\times\bar{i}=-a_2\bar{k}+a_3\bar{j}$

$\left(\bar{a}\times\bar{i}\right)^2=\left(\bar{a}\times\bar{i}\right).\left(\bar{a}\times\bar{i}\right)=\left(-a_2\bar{k}+a_3\bar{j}\right).\left(-a_2\bar{k}+a_3\bar{j}\right)$

$=a_2^2+a_3^2$

similarly $\left(\bar{a}\times\bar{j}\right)^2=a_3^2+a_1^2,\left(\bar{a}\times k\right)^2=a_1^2+a_2^2$

$\therefore\left(\bar{a}\times\bar{i}\right)^2+\left(\bar{a}\times\bar{j}\right)^2+\left(\bar{a}\times\bar{k}\right)^2=2|\bar{a}|^2$

2sol. Let $\bar{a}=6\bar{i}+2\bar{j}+3\bar{k}$, $\bar{b}=3\bar{i}-6\bar{j}-2\bar{k}$

$$\bar{a}\times\bar{b}=\begin{vmatrix}\bar{i}&\bar{j}&\bar{k}\\6&2&3\\3&-6&-2\end{vmatrix}=14\bar{i}+21\bar{j}-42\bar{k}=7\left(2\bar{i}+3\bar{j}-6\bar{k}\right)$$

$|\bar{a}\times\bar{b}|=49$

$\therefore\dfrac{\bar{a}\times\bar{b}}{|\bar{a}\times\bar{b}|}=\dfrac{1}{7}\left(2\bar{i}+3\bar{j}-6\bar{k}\right)$

3sol. $\bar{a}\times\bar{b}=\bar{a}\times\left(\bar{a}\times\bar{c}\right)=\left(\bar{a}.\bar{c}\right)\bar{a}-\left(\bar{a}.\bar{a}\right).\bar{c}=2\bar{a}-3\bar{c}$

$$\bar{a}\times\bar{b}=\begin{vmatrix}i&j&k\\1&1&1\\1&-2&1\end{vmatrix}=3\bar{i}-3\bar{k}$$

$\therefore\bar{c}=\dfrac{1}{3}\left(2\bar{a}-\bar{a}\times\bar{b}\right)=\dfrac{1}{3}\left(-\bar{i}+2\bar{j}+5\bar{k}\right)$

4sol. since $\bar{a}+\bar{b}+\bar{c}=0$

$\Rightarrow\bar{a}\times\left(\bar{a}+\bar{b}+\bar{c}\right)=0\Rightarrow a\times a+a\times b+a\times c=0$

$\Rightarrow\bar{a}\times\bar{b}=-\left(\bar{a}\times\bar{c}\right)\Rightarrow\bar{a}\times\bar{b}=\bar{c}\times\bar{a}\ \ldots\ldots 1)$

similarly $\bar{b}\times\left(\bar{a}+\bar{b}+\bar{c}\right)=0\Rightarrow\bar{a}\times\bar{b}=\bar{b}\times\bar{c}\ \ldots\ldots\ldots 2)$

From 1) and 2 $\bar{a}\times\bar{b}=\bar{b}\times\bar{c}=\bar{c}\times\bar{a}$

5sol. $$\bar{a}\times\bar{b}=\begin{vmatrix}\bar{i}&\bar{j}&\bar{k}\\2&3&-5\\m&n&12\end{vmatrix}$$

$=\left(36+5n\right)\bar{i}-\left(24+5m\right)\bar{j}+\left(2n-3m\right)\bar{k}=0$

$\Rightarrow m=-\dfrac{24}{5},n=-\dfrac{36}{5}$

6sol. $|\bar{b}\times\bar{c}|=\sqrt{15}\Rightarrow|\bar{b}|.|\bar{c}|\sin\theta=\sqrt{15}$

$\Rightarrow\sin\theta=\dfrac{\sqrt{15}}{4}\Rightarrow\cos\theta=\dfrac{1}{4}$

$\lambda\bar{a}=\bar{b}-2\bar{c}$

$\Rightarrow\lambda^2|\bar{a}|^2=|\bar{b}|^2+4|\bar{c}|^2-4|\bar{b}|.|\bar{c}|\cos\theta$

$\lambda^2=16+4-16\times\dfrac{1}{4}$

$\lambda^2=16\Rightarrow\lambda=\pm4$

7sol. $\overline{OA} = 3\overline{i} + 2\overline{j} - 9\overline{k}$, $\overline{F} = \left(9\overline{i} + 6\overline{j} - 2\overline{k}\right) \times \frac{6}{11}$

$\therefore$ Moment = $\overline{OA} \times F = \frac{6}{11}\begin{vmatrix} i & j & k \\ 3 & 2 & -9 \\ 9 & 6 & -2 \end{vmatrix} = \frac{6}{11}\left(50\overline{i} - 75\overline{j}\right) = \frac{150}{11}\left(2\overline{i} - 3\overline{j}\right)$

8sol. $\therefore n$ *is perpendicular to* $\overline{a}$ *and* $\overline{b}$

$$n = \frac{\overline{a} \times \overline{b}}{|a|.|b|} = \frac{\begin{vmatrix} i & j & k \\ 1 & -1 & 0 \\ 1 & 1 & 0 \end{vmatrix}}{\sqrt{2} \times \sqrt{2}} = \frac{2k}{2} = k$$

$|c.n| = \left|\left(\overline{i} + 3\overline{j} + 5\overline{k}\right).\left(\overline{k}\right)\right| = |5| = 5$

9. Let $b = b_1\overline{i} + b_2\overline{j} + b_3\overline{k}$

But $a.b = 1 \Rightarrow b_1 - b_2 + b_3 = 1$ ………..1)

And $a \times b = c \Rightarrow -\overline{i}\left(b_2 + b_3\right) + \overline{j}\left(b_1 - b_3\right) + k\left(b_2 + b_1\right) = -\overline{i} - \overline{j}$

Comparing the coefficient of $\overline{i}, \overline{j}, \overline{k}$

$b_2 + b_3 = 1$........2), $b_1 - b_3 = -1$......3) $b_2 + b_1 = 0$...........4)

Solving 1, 2, 3 & 4

Get $b_1 = 0, b_2 = 0, b_3 = 1$

10. vector area $= \frac{1}{2}\left(\overline{AB} \times \overline{AC}\right)$

$$= \frac{1}{2}\begin{vmatrix} i & j & k \\ -1 & 0 & 1 \\ 0 & -1 & 1 \end{vmatrix} = \frac{1}{2}\left(\overline{i} + \overline{j} + \overline{k}\right)$$

Hence by comparing , $\alpha = \overline{i} + \overline{j} + \overline{k}$

11sol. Vector perpendicular to face OPQ

$$= \begin{vmatrix} i & j & k \\ 1 & 2 & 1 \\ 2 & 1 & 3 \end{vmatrix} = 5\overline{i} - \overline{j} - 3\overline{k}$$

Vector perpendicular to face PQR

$$= \begin{vmatrix} i & j & k \\ 2 & 1 & -1 \\ 1 & -1 & 2 \end{vmatrix} = \overline{i} - 5\overline{j} - 3\overline{k}$$

Angle between two faces

$$\cos\theta = \left|\frac{5+5+9}{\sqrt{35}.\sqrt{35}}\right| = \frac{19}{35} \Rightarrow \theta = \cos^{-1}\left(\frac{19}{35}\right)$$

12sol. $\overline{d}_1 \times \overline{d}_2 = \begin{vmatrix} \overline{i} & \overline{j} & \overline{k} \\ 8 & -6 & 0 \\ 3 & 4 & -12 \end{vmatrix}$

$= 72\overline{i} + 96\overline{j} + 50\overline{k}$

$|\overline{d}_1 \times \overline{d}_2| = \sqrt{16,900} = 130$

$A = \frac{1}{2}\left|\overline{d}_1 \times \overline{d}_2\right| = \frac{1}{2} \times 130 = 65$

13sol. $\bar{a},\bar{b},\bar{c}$ from a right handed system, hence $\bar{b}\times\bar{a}=\bar{c}$

$\Rightarrow c=\bar{j}\times\left(x\bar{i}+y\bar{j}+z\bar{k}\right)$

$\Rightarrow c=-x\bar{k}+z\bar{i}=z\bar{i}-x\bar{k}$

14sol. $|\bar{a}\times\bar{b}|=1$

$\Rightarrow \sin\theta=1\Rightarrow \theta=\frac{\pi}{2}$

15sol. $\bar{a}\times\bar{b}=\bar{b}\times\bar{c}\neq 0$

$\Rightarrow \bar{a}\times\bar{b}-\bar{b}\times\bar{c}=0$

$\Rightarrow \bar{a}\times\bar{b}+\bar{c}\times\bar{b}=0$

$\Rightarrow (\bar{a}+\bar{c})\times\bar{b}=0$

$\therefore \bar{a}+\bar{c}$ is parallel to $\bar{b}$

$\Rightarrow \bar{a}+\bar{c}=K\bar{b}$

16sol. $a.b=|a|.|b|\cos\theta$

$|a\times b|=|a|.|b|\sin\theta$

$\Rightarrow \sin\theta=\frac{|a\times b|}{|a|.|b|}=\frac{4}{5}\Rightarrow \cos\theta=\frac{3}{5}$

$a.b=2\times 5\times\frac{3}{5}=6$

17sol. $\bar{c}\times\left(\bar{i}+2\bar{j}+5\bar{k}\right)=0$

$\bar{c}$ is parallel to $\bar{i}+2\bar{j}+5\bar{k}$

$\bar{c}=\lambda\left(\bar{i}+2\bar{j}+5\bar{k}\right)$

$|\bar{c}|^2=\lambda^2\left(1+4+25\right)$

$\lambda^2=\frac{60}{30}=2$

$\Rightarrow \lambda=\pm\sqrt{2}$

$\bar{c}.(-7\bar{i}+2\bar{j}+3\bar{k})=12\sqrt{2}$

18sol. $|a|=|b|=|c|=1$, $\bar{a}+\bar{b}+\bar{c}=0$

$\Rightarrow \bar{b}\times\bar{c}=\bar{a}\times\bar{b},\ \bar{c}\times\bar{a}=\bar{a}\times\bar{b}$

$|\bar{a}\times\bar{b}|+|\bar{b}\times\bar{c}|+|\bar{c}\times\bar{a}||=3|\bar{a}\times\bar{b}|$

$=3|\bar{a}||\bar{b}|\sin\frac{\pi}{3}$

$=3.1.1.\frac{\sqrt{3}}{2}=\frac{3\sqrt{3}}{2}$

19sol. $\bar{a}\times\bar{b}=\begin{vmatrix}\bar{i} & \bar{j} & \bar{k}\\ 3 & 2 & x\\ 1 & -1 & 1\end{vmatrix}$

$=\left(2+x\right)\bar{i}+\left(x-3\right)\bar{j}-5\bar{k}$

$|\bar{a}\times\bar{b}|=\sqrt{4+x^2+4x+x^2+9-6x+25}$

$|\bar{a}\times\bar{b}|=\sqrt{2x^2-2x+38}$ (minimum value $\frac{4ac-b^2}{4a}$)

$\Rightarrow|\bar{a}\times\bar{b}|\geq\sqrt{\frac{75}{2}}$

$\Rightarrow |\bar{a}\times\bar{b}| \geq 5\sqrt{\frac{3}{2}}$

20sol. $\left(\bar{a}+\bar{b}\right)\times\left(\bar{a}-\bar{b}\right)=2\left(\bar{b}\times\bar{a}\right)$

$$=2\begin{vmatrix} i & j & k \\ 1 & 2 & -2 \\ 3 & 2 & 2 \end{vmatrix}=2\left(8i-8j+4k\right)$$

Required vector = $\pm 12\frac{(2\bar{i}-2\bar{j}-k)}{3}$ = $\pm 4(2\bar{i}-2\bar{j}-k)$

21. $f'(x)=3kx^2-18x+6 \Rightarrow f'(x)>0 \Rightarrow b^2-4ac<0, a>0$

22. $f(x)=x^{\frac{1}{x}} \Rightarrow \log f(x)=\frac{1}{x}\log x,\ x>0$

$$\frac{f'(x)}{f(x)}=\frac{\frac{x}{x}-\log x}{x^2}=\frac{1-\log x}{x^2} \Rightarrow 1>\log x$$

$\Rightarrow e>x,\ x<e,\ x>0 \Rightarrow 0<x<e$

23. $f(x)=\int_0^x e^t(t-1)(t-2)dt \Rightarrow f'(x)=e^x(x-1)(x-2)<0$

$\Rightarrow (x-1)(x-2)<0\ \left(\because e^x>0\right) \Rightarrow x\in(1,2)$

24. $f(x)=\sin^4 x+\cos^4 x = 1-2\sin^2 x\cos^2 x = 1-\frac{1}{2}\sin^2 2x$

$f(x)=\frac{3}{4}+\frac{1}{4}\cos 4x \Rightarrow f'(x)>0$

25. $f(x)=x^3+ax^2+bx+5\sin^2 x$

$f'(x)=3x^2+2ax+b+10\sin x\cos x$

$f'(x)=3x^2+2ax+b+5\sin 2x>0$

$=3x^2+2ax-5>0\ \left(\because -1\leq \sin 2x\leq 1\right)$

$b^2-4ac<0 \Rightarrow a^2-3b+15<0$

26. $f(x)=\frac{1}{2}\left[|\sin x|+\sin x\right]=\sin x\ \ where\ 0<x\leq\pi$

$=0\ \ when\ \pi<x\leq 2\pi$

$f(x)$ increasing in $\left(0,\frac{\pi}{2}\right)$ and decreasing in $\left(\frac{\pi}{2},-\pi\right)$

27. $f(x)=\cos^{-1}x \Rightarrow f'(x)=\frac{-1}{\sqrt{1-x^2}}<0$ if $1-x^2>0$

$\Rightarrow x\in(-1,1)$

28. $\frac{d}{dx}\left(\cos x+\sin x\right)=-\sin x+\cos x>0,\ \forall x\in\left(0,\frac{\pi}{4}\right)$

$\therefore \cos x+\sin x$ is increasing in $\left(0,\frac{\pi}{4}\right)$

29. $$f(x)=\begin{vmatrix} x+a^2 & ab & ac \\ ab & x+b^2 & bc \\ ac & bc & x+c^2 \end{vmatrix}=\frac{1}{a}\begin{vmatrix} a^3+ax & ab & ac \\ a^2b & b^2+x & bc \\ a^2c & bc & c^2+x \end{vmatrix} c_1+bc_2+cc_3$$

$$=\frac{1}{a}\left(a^2+b^2+c^2+x\right)\begin{vmatrix} a & ab & ac \\ b & b^2+x & bc \\ c & bc & c^2+x \end{vmatrix} c_2-bc_1, c_3-cc_1$$

$$=\frac{1}{a}\left(a^2+b^2+c^2+x\right)\begin{vmatrix} a & 0 & 0 \\ b & x & 0 \\ c & 0 & x \end{vmatrix}=x^2\left(a^2+b^2+c^2+x\right)$$

$$=f'(x)=x^2+2x\left(a^2+b^2+c+x\right)<0\Rightarrow x\in\left(-\frac{2}{3}(a^2+b^2+c^2),0\right)$$

30. $f(x)=\log(1+x)-\frac{2x}{2+x}\Rightarrow f'(x)=\frac{1}{1+x}-\frac{(2+x)2-2x}{(2+x)^2}$

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

31. $f(x)=ax^3+bx^2+cx\Rightarrow f'(x)=3ax^2+2bx+c$

Given $3ax^2+2bx+c$ has atleast one root α be there 0 and 1 $\Rightarrow f'(\alpha)=0$

By Rolle's theorem $f(0)=f(1)\Rightarrow a+b+c=0$

32. $\therefore f(x)=\log x, f'(x)=\frac{1}{x}$

By lagranges theorem $c\in(1,e)$

$f'(c)=\frac{f(b)-f(a)}{b-a}\Rightarrow \frac{1}{c}=\frac{f(e)-f(1)}{e-1}$

33. $f(x)=x^3-6x^2+ax+b$

$f'(x)=3x^2-12x+a$

By Rolles theorem $C\in(1,3)\Rightarrow f'(C)=0$

34. By Rolle's theorem $\int_a^b f'(x)dx=f(b)-f(a)=0$

35. $f'(c)=\frac{f(b)-f(a)}{b-a}$

$f(x)=x(x-2)^2$

$f'(x)=x2(x-2)+(x-2)^2$

$a=0, b=2$

36. $f(a)-f(b)=0$

By Lagranges theorem

$f'(c)=\frac{f(b)-f(a)}{b-a}=0,\ c\in(a,b)$

37. $f(x)$ is continuous on $[0,\pi]$ and derivable on $(0,\pi)$

$f'(x)=2\cos x+2\cos 2x$

$f'(c)=\frac{f(\pi)-f(0)}{\pi-0}$

$2\cos c+2\cos 2c=0\Rightarrow \cos c=-1\ or\ \frac{1}{2}$

$c=\frac{\pi}{3}$

38. $f'(c)=\frac{f(1)-f(0)}{1}=4$

$g'(c) = \frac{g(1)-g(0)}{1} = 2 \Rightarrow f'(x) = 2g'(c)$

39. $f(x) = 2x^3 + ax^2 + bx \Rightarrow f'(x) = 6x^2 + 2ax + b$

$f(-1) = f(1) \Rightarrow -2 + a - b = 2 + a + b$

$b = -2 \ldots\ldots\ldots 1)$

$f'\left(\frac{1}{2}\right) = 0 \Rightarrow 2a + 2b + 3 = 0 \Rightarrow a = \frac{1}{2}$

$2a + b = 2\left(\frac{1}{2}\right) + (-2) \Rightarrow -1$

40. $f(x) = x^2 - 2x + 3$ is polynomial function.

$\Rightarrow f$ is continuous on $[1, 3/2]$ and derivable on $(1, 3/2)$

$f'(x) = 2x - 2$

$$f'(1+\theta/2) = \frac{f\left(\frac{3}{2}\right) - f(1)}{\frac{3}{2} - 1} \Rightarrow 2\left(1 + \frac{\theta}{2}\right) - 2 = \frac{\frac{9}{4} - 2}{\frac{1}{2}}$$

$\Rightarrow \theta = \frac{1}{2}$

PHYSICS

41. Energy gained by the boy in eating bananas = 980 calories = $980 \times 4.2 J$

If m is the mass of the boy, the potential energy gained by the boy in going up through a height ‘h’ is mgh.

Energy = potential energy

$980 \times 4.2 = mgh$

$980 \times 4.2 = 42 \times 9.8 \times h$

$h = \frac{980 \times 4.2}{42 \times 9.8} = 10m$

42. 1 atmosphere = $1.013 \times 10^5 N/m^2$

Volume of 1gm of water

$V_1 = 1cc = 10^{-6} m^3$

Volume of steam = $1671cc$

$= 1671 \times 10^{-6} m^3$

External work done = $dw = P(V_2 - V_1)$

$= 1.013 \times 10^5 \left(1671 \times 10^{-6} - 1 \times 10^{-6}\right)$

$= 1.013 \times 167 = 169.2J$

Latent heat of vaporization of steam = 540 cal/g

Heat supplied to convert 1g of water into steam

$\Delta Q = 540 \times 42J = 2268J$

First law of thermodynamics

$\Delta U = \Delta Q - \Delta W$

$\Delta U = \Delta Q - \Delta W = 2268 - 169.2$

$= 2098.8J$

43. $m = 5kg, dT = 340 - 300 = 40K$

$C_V = 0.169\ Kcal/kg\ K$

Principle specific heat at constant

Volume $C_V = \frac{dQ}{mdT}$

The amount of heat absorbed

$dQ = mC_V dT$

$= 5 \times 0.169 \times 40 = 33.8k.cal$

44. In a cyclic process $\Delta U = 0$

$\therefore \Delta Q = \Delta W$

$(100-20) = 20 + W_2$

$W_2 = +60J$

45. $W_{BA} = -30J$

$Q_{BA} = 0$

$\therefore \Delta U_{BA} = -W_{BA} = 30J$

In cyclic process $\Delta U = 0$

Now, $\Delta U_{AB} = -\Delta U_{BA}$ = -30J

46. For an ideal gas of one mole

$PV = RT^3$

During an adiabatic process

$P \propto T^3$

$P = KT^3$

$P = K\left(\frac{PV}{R}\right)^3$

$P = \left(\frac{K}{R^3}\right)P^3V^3$

$P^2V^3 = cons\tan t$

$PV^{2/3}$=constant

Comparing in with the equation

$PV^r = const$

$r = \frac{3}{2}$

47. P-V diagram of the gas is a straight line passing through origin

$P \propto V$ (or) $PV^{-1} = cons\tan t$

Molar heat capacity in the process

PV^n = constant

$C = \frac{R}{r-1} + \frac{R}{1-n}$

Here $r = 1.4$ (for diatomic gas)

$n = -1$

$\therefore C = \frac{R}{14-1} + \frac{R}{1+1}$

$\therefore C = 3R$

48. $\frac{T_2}{T_1} = 1 - \eta = 1 - \frac{40}{100} = \frac{3}{5}$

$T_1 = \frac{5}{3}T_2$

$T_1 = \frac{5}{3} \times 300 = 500K$

New efficiency $\eta = 60\%$

$\frac{T_2}{T_1} = 1 - \eta = 1 - \frac{60}{100} = \frac{2}{5}$

$T_1 = \frac{5}{2} \times 300 = 750K$

$\Delta T = 750 - 500 = 250K$

49. Conceptual

50. Conceptual

51. $du = C_V dT = \left(\frac{5}{2}R\right)dT$

$dT = \frac{2(du)}{5R}$

From first law of thermodynamics $du = dQ - dw$

$= Q - \frac{Q}{4} = \frac{3Q}{4}$

Now molar heat capacity

$C = \frac{dQ}{dT} = \frac{Q \times 5R}{2(du)} = \frac{5RQ}{2\left(\frac{3Q}{4}\right)} = \frac{10}{3}R$

52. $\frac{Q_2}{Q_1} = \frac{T_2}{T_1} = \frac{3}{5}$

$Q_1 - Q_2 = w = 10^3 J$

$Q_1\left(1 - \frac{Q_2}{Q_1}\right) = 10^3 J$

$Q_1\left(1 - \frac{3}{5}\right) = 10^3 J$

$Q_1 = \frac{5}{2} \times 10^3 = 2500J$

$Q_2 = Q_1 \frac{3}{5} = 2500 \times \frac{3}{5} = 1500J$

53. $\frac{m_1}{m_2} = \frac{2}{3}$

$\frac{s_1}{s_2} = \frac{2}{3}$

$\frac{\Delta t_1}{\Delta t_2} = \frac{h_1}{h_2}$

$mgh = J\, ms\Delta t$

$\frac{\Delta t_1}{\Delta t_2} = \frac{k_1}{h_2}\frac{s_2}{s_1}$

$\frac{1}{2} = \frac{h_1}{h_2} \times \frac{3}{2}$

$\frac{h_1}{h_2} = \frac{1}{3}$

54. $w = pdv$

$= 2 \times 10^5 (10 - 5)$

$= 1000J$

55. $w = nRT\ \log_e\left(\frac{V_2}{V_1}\right)$

$= 1\times 2\times 300\log_e(2)$

$= 1\times 2\times 300\times 0.6931$

$= 415 cal$

56. $\frac{1}{2}m\left(v^2 - \frac{v^2}{4}\right) = ms(\Delta t_1)$

$\frac{1}{2}m\left(v^2 - o^2\right) = ms(\Delta t_2)$

$\frac{\Delta t_1}{\Delta t_2} = \frac{3}{4}$

57. $k = \frac{T_2}{T_1 - T_2}$

$5 = \frac{273-13}{T_1-(273-13)}$

$5 = \frac{260}{T_1 - 260}$

$T_1 = 312K = 39^0 C$

58.

$PV^r = K$

$\frac{\Delta P}{P}\times 100 = -r\frac{\Delta V}{V}\times 100$

$= -1.4\times 5 = -7\%$

Decrease by 7%

59. diameter = 30 – 10 = 20

Radius = 10

W = area

$= \pi r^2 = \pi\times 10^2 = 10^2\pi$

60. Work done = area bounded by P-V graph

$= \frac{1}{2}(3V - V)(3P - P)$

$= \frac{1}{2}\times 2V\times 2P$ = 2PV

CHEMISTRY

61. $ROH + R'Mgx \rightarrow R - H + ROMgx$

62. Conceptual

63. $2CH_3COONa + 2H_2O \xrightarrow{electrolysis} CH_3 - CH_3 + 2CO_2 + 2NaOH + H_2$

64. $2R - X + 2Na \xrightarrow{dry\,ether} R - R + 2NaX$

65. Staggered conformation form at 60^0, 180^0, and 300^0C

66. $2C_2H_5 - Cl + 2Na \xrightarrow{dry\ ether} CH_3 - CH_2 - CH_2 - CH_3 + 2NaCl$

67. there are 6 primary hydrogen and 2 – secondary hydrogens

1-chloro propene = $\frac{6}{8}\times 100 = 75\%$

68. 2,3 – dimethyl butane has only two different type of hydrogens

69. no of oxygen molecules required for alkanes, combustion $= n + \left(\frac{2n+2}{4}\right)\ (or)\ \frac{3n+1}{2}$

70. $Al_4C_3 \xrightarrow{Hydrolysis} CH_4 \xrightarrow[HNO_3]{400^0-475^0 C} CH_3NO_2$

71. 2-pentene

72.

$$CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 \xrightarrow{alc.KOH} CH_3-CH=CH_2$$

73. $CH_2=CH_2+HBr \rightarrow CH_3-CH_2-Br \xrightarrow{Na/dry\,ether} CH_3-CH_2-CH_3$

74. $CH_2=CH_2$

75.

$$CH_2=CH_2 \xrightarrow[Ag]{O_2} \overset{\quad O \quad}{CH_2-CH_2}$$

76. $HCHO+OHCH \rightarrow CH_2=CH_2$

Remove oxygen and insert a double bond between carbons to get ethene

77. Conceptual

78.

$$CH_3-CH=CH_2 \xrightarrow{HBr} CH_3-CH(Br)-CH_2 \xrightarrow{Alc.KOH} CH_3-CH=CH_2 \xrightarrow[H_2O]{O_2/Zn} CH_3CHO+HCHO$$

79. Benzene does not decolourise pink of alc.$KMnO_4$

80. Markovnikov Rule

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