MELUHA INTERNATIONAL SCHOOL
HYDERABAD

SR MPC | **JEE MAINS MODEL UT-II** | **Date: 02-06-2020**
Time: 3 Hours | **Max. Marks: 300 M**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

SYLLABUS: Definite and Indefinite Integration.

1. $\int \frac{\sin x+4\sin 3x+6\sin 5x+3\sin 7x}{\sin 2x+3\sin 4x+3\sin 6x}dx$ **equals**

A) $-2\sin x+c$ B) $2\sin x+c$ C) $-2\cos x+c$ D) $2\cos x+c$

2. $\int \frac{\sin x}{\sin 4x}dx$ **is equal to**

A) $\frac{1}{2\sqrt{2}}ln\left|\frac{1+\sqrt{2}\sin x}{1-\sqrt{2}\sin x}\right|+\frac{1}{8}ln\left|\frac{1+\sin x}{1-\sin x}\right|+c$ B) $\frac{1}{2\sqrt{2}}ln\left|\frac{1+\sqrt{2}\sin x}{1-\sqrt{2}\sin x}\right|-\frac{1}{8}ln\left|\frac{1+\sin x}{1-\sin x}\right|+c$

C) $\frac{1}{4\sqrt{2}}ln\left|\frac{1+\sqrt{2}\sin x}{1-\sqrt{2}\sin x}\right|+\frac{1}{8}ln\left|\frac{1+\sin x}{1-\sin x}\right|+c$ D) $\frac{1}{4\sqrt{2}}ln\left|\frac{1+\sqrt{2}\sin x}{1-\sqrt{2}\sin x}\right|-\frac{1}{8}ln\left|\frac{1+\sin x}{1-\sin x}\right|+c$

3. **The value of integral** $\int \frac{d\theta}{\cos^3\theta\sqrt{\sin 2\theta}}$ **can be expressed as irrational function of** $\tan\theta$ **as**

A) $\frac{\sqrt{2}}{5}\left(\sqrt{\tan^2\theta+5}\right)\tan\theta+c$ B) $\frac{2}{5}\left(\tan^2\theta+5\right)\sqrt{\tan\theta}+c$

C) $\frac{\sqrt{2}}{5}\left(\tan^2\theta+5\right)\sqrt{\tan\theta}+c$ D) $\sqrt{\frac{2}{5}}\left(\tan^2\theta+5\right)\sqrt{\tan\theta}+c$

4. **If** $\int \frac{\sin x}{\sin(x-\alpha)}dx=Ax+B\log\sin(x-\alpha)+C$ **then values of (A, B) is**

A) $(\sin\alpha,\cos\alpha)$ B) $(\cos\alpha,\sin\alpha)$ C) $(-\sin\alpha,\cos\alpha)$ D) $(-\cos\alpha,\sin\alpha)$

5. **If the integral** $\int \frac{5\tan x}{\tan x-2}dx=x+a\ln\left|\sin x-2\cos x\right|+k$ **then a is equal to**

A) 2 B) -1 C) -2 D) 1

6. **If** $\int f(x)dx=\psi(x)$, **then** $\int x^5 f\left(x^3\right)dx$ **is equal to**

A) $\frac{1}{3}\left[x^3\psi\left(x^3\right)-\int x^2\psi\left(x^3\right)dx\right]+C$ B) $\frac{1}{3}x^3\psi\left(x^3\right)-3\int x^3\psi\left(x^3\right)dx+C$

C) $\frac{1}{3}x^3\psi\left(x^3\right)-3\int x^2\psi\left(x^3\right)dx+C$ D) $\frac{1}{3}\left[x^3\psi\left(x^3\right)-\int x^3\psi\left(x^3\right)dx\right]+C$

7. **Let** $f(x)=\dfrac{x}{\left(1+x^n\right)^{1/n}}$ **for** $n\geq 2$ **and** $g(x)=\underbrace{fofo.....of}_{\text{f occurs n terms}}(x)$. **Then** $\int x^{n-2}g(x)dx$ **equals**

A) $\dfrac{1}{n(n-1)}\left(1+nx^n\right)^{1-\frac{1}{n}}+K$ B) $\dfrac{1}{n-1}\left(1+nx^n\right)^{1-\frac{1}{n}}+K$

C) $\dfrac{1}{n(n+1)}\left(1+nx^n\right)^{1+\frac{1}{n}}+K$ D) $\dfrac{1}{n+1}\left(1+nx^n\right)^{1+\frac{1}{n}}+K$

8. **Let** $I=\int\dfrac{e^x}{e^{4x}+e^{2x}+1}dx,\ J=\int\dfrac{e^{-x}}{e^{-4x}+e^{-2x}+1}dx.$ **Then, for an arbitrary constant c, the value of** $J-I$ **equals**

A) $\dfrac{1}{2}\log\left(\dfrac{e^{4x}-e^{2x}+1}{e^{4x}+e^{2x}+1}\right)+c$ B) $\dfrac{1}{2}\log\left(\dfrac{e^{4x}+e^{2x}+1}{e^{2x}-e^{2x}+1}\right)+c$

C) $\dfrac{1}{2}\log\left(\dfrac{e^{2x}-e^{x}+1}{e^{2x}+e^{x}+1}\right)+c$ D) $\dfrac{1}{2}\log\left(\dfrac{e^{4x}+e^{2x}+1}{e^{4x}-e^{2x}+1}\right)+c$

9. $\int\dfrac{\sec^2 x}{(\sec x+\tan x)^{9/2}}dx$ **equals (for some arbitrary constant K)**

A) $-\dfrac{1}{(\sec x+\tan x)^{11/2}}\left\{\dfrac{1}{11}-\dfrac{1}{7}(\sec x+\tan x)^2\right\}+K$

B) $\dfrac{1}{(\sec x+\tan x)^{11/2}}\left\{\dfrac{1}{11}-\dfrac{1}{7}(\sec x+\tan x)^2\right\}+K$

C) $-\dfrac{1}{(\sec x+\tan x)^{11/2}}\left\{\dfrac{1}{11}+\dfrac{1}{7}(\sec x+\tan x)^2\right\}+K$

D) $\dfrac{1}{(\sec x+\tan x)^{11/2}}\left\{\dfrac{1}{11}+\dfrac{1}{7}(\sec x+\tan x)^2\right\}+K$

10. $\int\dfrac{dx}{\cos x+\sqrt{3}\sin x}$ **equals**

A) $\dfrac{1}{2}\log\tan\left(\dfrac{x}{2}+\dfrac{\pi}{12}\right)+C$ B) $\dfrac{1}{2}\log\tan\left(\dfrac{x}{2}-\dfrac{\pi}{12}\right)+C$

C) $\log\tan\left(\dfrac{x}{2}+\dfrac{\pi}{12}\right)+C$ D) $\log\tan\left(\dfrac{x}{2}-\dfrac{\pi}{12}\right)+C$

11. **The value of** $\int_1^e\left((x+1)e^x.l\,nx\right)dx$ **is**

A) e B) e^{e+1} C) $e^e(e-1)$ D) $e^e(e-1)+e$

12. **Suppose that** $F(x)$ **is an antiderivative of** $f(x)=\dfrac{\sin x}{x},\ x>0$ **then** $\int_1^3\dfrac{\sin 2x}{x}dx$ **can be expressed as**

A) $F(6)-F(2)$ B) $\dfrac{1}{2}(F(6)-F(2))$ C) $\dfrac{1}{2}(F(3)-F(1))$ D) $2(F(6)-F(2))$

13. **Let** $f(x)=\int_2^x\dfrac{dt}{\sqrt{1+t^4}}$ **and 'g' be the inverse of 'f'. Then the value of** $g^1(0)$ **is**

A) 1 B) 17 C) $\sqrt{17}$ D) None of these

14. **The value of** $\int_0^1 \left(\prod_{r=1}^{n} (x+r) \right) \left(\sum_{k=1}^{n} \frac{1}{x+k} \right) dx$ **equals**

A) n B) n! C) (n+1)! D) n.n!

15. $\int_{\pi}^{10\pi} |\sin x| dx =$

A) 9 B) 10 C) 18 D) 20

16. $\lim_{n\to\infty} \left[\frac{1}{n^2} \sec^2 \frac{1}{n^2} + \frac{2}{n^2} \sec^2 \frac{4}{n^2} + ... + \frac{1}{n} \sec^2 1 \right]$ **equals**

A) $\frac{1}{2}\sec 1$ B) $\frac{1}{2}\text{cosec}1$ C) $\tan 1$ D) $\frac{1}{2}\tan 1$

17. **Let [.] denote the greatest integer function then the value of** $\int_0^{1.5} x\left[x^2 \right] dx$ **is**

A) $\frac{5}{4}$ B) 0 C) $\frac{3}{2}$ D) $\frac{3}{4}$

18. **The value of** $\int_{-\pi}^{\pi} \frac{\cos^2 x}{1+a^x} dx,\ a>0$ **is**

A) π B) $a\pi$ C) $\frac{\pi}{2}$ D) 2π

19. **If** $f(x) = \frac{e^x}{1+e^x}$, $I_1 = \int_{f(-a)}^{f(a)} xg\{x(1-x)\} dx$ **and** $I_2 = \int_{f(-a)}^{f(a)} g\{x(1-x)\} dx,$ **then the value of** $\frac{I_2}{I_1}$ **is**

A) 2 B) – 3 C) – 1 D) 1

20. **If** $I_1 = \int_0^1 2^{x^2} dx, I_2 = \int_0^1 2^{x^3} dx, I_3 = \int_1^2 2^{x^2} dx$ **and** $I_4 = \int_1^2 2^{x^3} dx$ **then**

A) $I_2 > I_1$ B) $I_1 > I_2$ C) $I_3 = I_4$ D) $I_3 > I_4$

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking scheme: +4 for correct answer, 0 in all other cases.

21. **Let 'f' be a function satisfying** $f^{11}(x) = x^{-3/2}$, $f^1(4) = 2$ **and** $f(0) = 0.$ **Then** $f(784)$ **is equal to ……**

22. **Let f(x) is a quadratic function such that** $f(0) = 1$ **and** $\int \frac{f(x)dx}{x^2(x+1)^3}$ **is a rational function, find the value of** $f^1(0)$

23. **Let F(x) be the antiderivative of** $f(x) = 3\cos x - 2\sin x$ **whose graph passes through the point** $(\pi/2, 1).$ **Then** $F(\pi/2) = ...$

24. **The value of** $\int_{-2}^{3} |1-x^2| dx$ **is**

25. **Let** $\frac{d}{dx}F(x) = \left(\frac{e^{\sin x}}{x} \right),\ x>0.$ **If** $\int_1^4 \frac{3}{x} e^{\sin x^3} dx = F(k) - F(1),$ **then one of the possible values of k, is**

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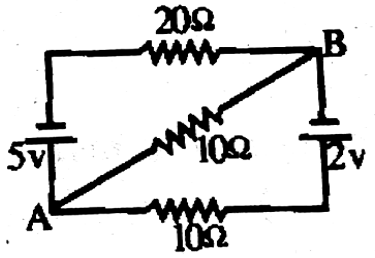
PHYSICS

SYLLABUS: Electrostatics, Current Electricity, Gravitation.

26. The P.d between the terminals A & B is

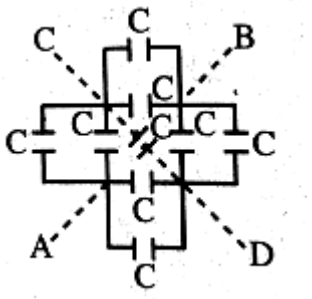


A) 2v B) 3v C) 3.6v D) 1.8v

27. A potentiometer wire has length 4m and resistance 8Ω. The resistance that must be connected in series with the wire and an accumulator of e.m.f. 2v, so as to get a potential gradient 1mV per cm on the wire is:

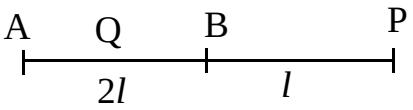
A) 44Ω B) 48Ω C) 32Ω D) 40Ω

28. The equivalent capacity between the points A and B in the adjoining circuit will be



A) C B) 2C C) 3C D) 4C

29. Charge Q is uniformly distributed on a dielectric rod AB of length 21. The potential at P shown in the figure is equal to



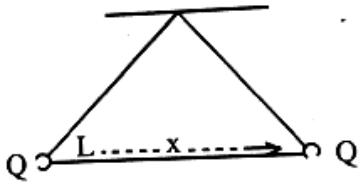
A) $\frac{q}{4\pi\varepsilon_0 2l}$ B) $\frac{q}{4\pi\varepsilon_0}ln(2)$ C) $\frac{q}{4\pi\varepsilon_0 2l}ln(3)$ D) $\frac{2q}{4\pi\varepsilon_0 l}ln(3)$

30. A spherically symmetric charge distribution is characterized by a charge density having the following variation:

$\rho(r)=\rho_0\left(1-\frac{r}{R}\right)$ **for** $r<R$, $\rho(r)=0$ **for** $r\geq R$ **where 'r' is the distance from the centre of the charge distribution and** ρ_0 **is a constant. The electric field at an internal point** $(r<R)$ **is**

A) $\frac{\rho_0}{\varepsilon_0}\left(\frac{r}{3}-\frac{r^2}{4R}\right)$ B) $\frac{\rho_0}{4\varepsilon_0}\left(\frac{r}{3}-\frac{r^2}{4R}\right)$ C) $\frac{\rho_0}{3\varepsilon_0}\left(\frac{r}{3}-\frac{r^2}{4R}\right)$ D) $\frac{\rho_0}{12\varepsilon_0}\left(\frac{r}{3}-\frac{r^2}{4R}\right)$

31. Two similar balls of mass 'm' are hung by a silk thread of length 'L' and carry similar charges Q as in figure. Assuming the separation to be small the separation between the balls (denoted by x) is equal to



A) $\left[\frac{Q^2.2L}{4\pi\varepsilon_0.mg}\right]^{\frac{1}{3}}$ B) $QLmg$ C) $\frac{QL}{mg}$ D) $\frac{Q^2L}{2\pi mg}$

32. An electric dipole of moment $\vec{p}=\left(-\hat{i}-3\hat{j}+2\hat{k}\right)\times10^{-29}$ cm is at the origin (0, 0, 0). The electric field due to this dipole at $\vec{r}=\left(+\hat{i}+3\hat{j}+5\hat{k}\right)$ (note that $\vec{r}.\vec{p}=0$) is parallel to:

A) $\left(+\hat{i}+3\hat{j}-2\hat{k}\right)$ B) $\left(-\hat{i}+3\hat{j}-2\hat{k}\right)$ C) $\left(+\hat{i}-3\hat{j}-2\hat{k}\right)$ D) $\left(-\hat{i}-3\hat{j}+2\hat{k}\right)$

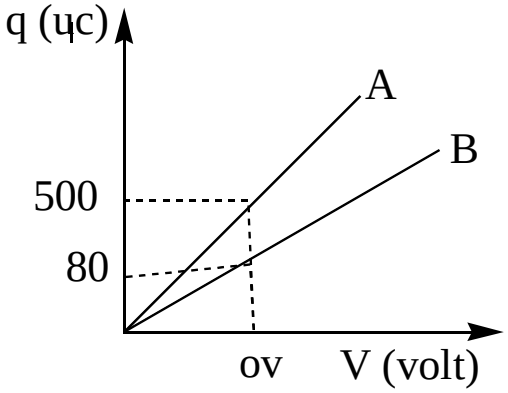
33. Two equal resistances when connected in series to a battery, consume electric power of 60w. If there resistances are now connected in parallel combination to the same battery, the electric power consumed will be

A) 120 W B) 60 W C) 30 W D) 240 W

34. The length of a potentiometer wire is 1200cm and it carries a current of 60mA. For a cell of emf 5v and internal resistance of 20Ω, the null point on it is found to be at 1000 cm. The resistance of whole wire is:

A) 60Ω B) 120Ω C) 100Ω D) 80Ω

35. Figure shows charge (q) versus voltage (v) graph for series and parallel combination of two given capacitors. The capacitances are:



A) $20\,\mu F$ and $30\,\mu F$ B) $50\,\mu F$ and $30\,\mu F$

C) $60\,\mu F$ and $40\,\mu F$ D) $40\,\mu F$ and $10\,\mu F$

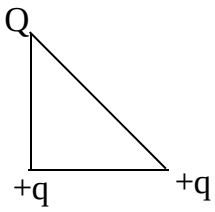
36. Three concentric metal shells A, B and C of respective radii a, b and c $(a<b<c)$ have surface charge densities $+\sigma,-\sigma$ and $+\sigma$ respectively. The potential of shell B is

A) $\frac{\sigma}{\varepsilon_0}\left[\frac{a^2-b^2}{b}+c\right]$ B) $\frac{\sigma}{\varepsilon_0}\left[\frac{b^2-c^2}{b}+a\right]$ C) $\frac{\sigma}{\varepsilon_0}\left[\frac{b^2-c^2}{c}+a\right]$ D) $\frac{\sigma}{\varepsilon_0}\left[\frac{a^2-b^2}{a}+c\right]$

37. In a meterbridge experiment, when a nichrome wire is in the right gap, the balancing length is 60 cm. When the nichrome wire is uniformly stretched to increase its length by 20% and again connected in the right gap, the new balancing length is nearly

A) 61 cm B) 31 cm C) 51 cm D) 41 cm

38. Three charges Q, +q and +q placed at the vertices of a right angle isosceles triangle as shown below. The net electrostatic energy of the configuration is zero, if the value of Q is:



A) +q B) $\frac{-\sqrt{2}q}{\sqrt{2}+1}$ C) $-\sqrt{2}q$ D) $\frac{-q}{1+\sqrt{2}}$

39. Two identical conducting spheres A and B carry equal charge. They are separated by a distance much larger than their diameters and the force between them is F.A third identical conducting sphere C is uncharged. Sphere C is first touched to A then to B and then removed. As a result the force between A and B would be equal to:

A) $\frac{3F}{4}$ B) $\frac{F}{2}$ C) $\frac{3F}{8}$ D) F

40. A capacitance of μF is required in an electrical circuit across a potential difference of 1.0 kV. A large number of $1\mu F$ capacitors are available which can withstand a potential difference of not more than 300v. The minimum number of capacitors required to achieve this is:

A) 16 B) 24 C) 32 D) 2

41. A particle of mass M is situated at the centre of a spherical shell of same mass and radius 'a'. The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre will be

A) $-\frac{3GM}{a}$ B) $-\frac{2GM}{a}$ C) $-\frac{GM}{a}$ D) $-\frac{4GM}{a}$

42. A body is suspended on a spring balance in a ship sailing along the equator with a speed 'V'. If 'ω' is the angular speed of the earth and 'W_0' is the scale reading when the ship is at rest. The scale reading when that ship is sailing will be very close to:

A) W_0 B) $W_0\left(1+\frac{2\omega V}{g}\right)$ C) $W_0\left(1\pm\frac{2\omega V}{g}\right)$ D) None of these

43. A rocket is fired vertically from the ground with resultant vertical acceleration of 10 m/sec^2. If the fuel is finished in one minute and it continues to move up, the maximum height reached by it is nearly:

A) 40 km B) 20 km C) 10 km D) 80 km

44. The metallic bob of a simple pendulum has the relative density 'ρ'. The time period of this pendulum is 'T'. If the metallic bob is immersed in water, then the new time period is given by:

A) $T\left(\frac{\rho-1}{\rho}\right)$ B) $\frac{\rho}{(\rho-1)}T$ C) $\sqrt{\left(\frac{\rho-1}{\rho}\right)}T$ D) $\sqrt{\frac{\rho}{(\rho-1)}}\,T$

45. An asteroid of mass 'm' is approaching the earth, initially at a distance of 10 R_e with speed V_i. It hits the earth with a speed V_f (R_e and M_e are radius and mass of the earth), then:

A) $V_f^2=V_i^2+\frac{2Gm}{M_eR_e}\left(1-\frac{1}{10}\right)$ B) $V_f^2=V_i^2+\frac{2GM_e}{R_e}\left(1+\frac{1}{10}\right)$

C) $V_f^2=V_i^2+\frac{2GM_e}{R_e}\left(1-\frac{1}{10}\right)$ D) $V_f^2=V_i^2+\frac{2Gm}{R_e}\left(1-\frac{1}{10}\right)$

SECTION- II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
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46. **The dipole moment of water molecule is** 6.17×10^{-30} cm. **Find the effective separation between the positive and negative charges (In pm)**

47. **If one of the two electrons of a H_2 molecule is removed, we get a hydrogen molecular ion. In the ground state of an** H_2^+, **the two protons are separated by roughly 1.5 A^0 and the electron is roughly 1A^0 from each proton. Determine the potential energy of the system in eV**

48. **A potentiometer has a wire of 100 cm length and its resistance is** 10Ω. **It is connected in series with a resistance of** 40Ω **and a battery of emf 2V and negligible internal resistance. If a source of unknown emf E is connected in the secondary is balanced by 40 cm length of potentiometer wire, the value of E in V**

49. **If the magnitude of the drift speed of free electrons in copper wire is** $7.84\times10^{-4}\,m/s$. **What is electric field inside the conductor in V/m. [Resistivity of copper is** $1.7\times10^{-8}\Omega m$ **and electron density is** 8.4×10^{28} **electrons / m^3]**

50. **Two spherical bodies of mass M and 5M and radii R and 2R released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then distance covered by smaller body before collision is nR, then n =**

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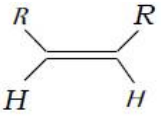
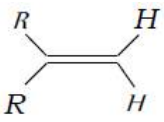
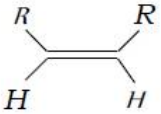
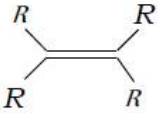
CHEMISTRY

SYLLABUS: Hydrocarbon.

51. **Which one of the following alkenes will react fastest with H under catalytic hydrogenation condition?**

A) 
B) 
C) 
D) 

52. **On cracking petrol, we get**
A) CH_4 B) C_3H_6
C) Both (A) and (B) D) $CH_3 + CH_4 + C_2H_6$ + alcohols

53. **Cetane is a compound which has very good ignition property. Chemically it is**
A) $CH_3(CH_2)_{14}CH_3$ B) $(CH_3)_3C(CH_2)_{11}CH_3$
C) $C_{17}H_{34}$ D) None of these

54. **Which one of these is not compatible with arenes?**
A) Greater stability B) Delocalization of $\pi-$electrons
C) Electrophilic additions D) Resonance

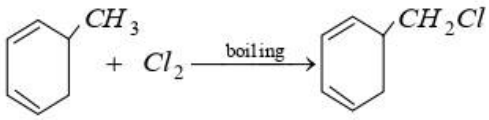
55. **The reaction,** $\underset{\text{Ethylene}}{H_2C=CH_2}+\underset{\text{Water}}{H_2O}\xrightarrow[300^0C/60atm]{H_3PO_4}\underset{\text{Ethyl alcohol}}{C_2H_5OH}$ **is called**
A) Hydration B) Sublimation C) Dehydration D) Substitution

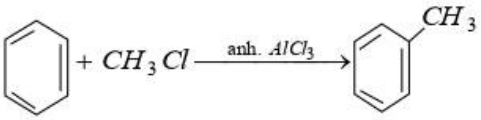
56. **In reaction** $C_6H_5CH_3 \xrightarrow[\text{Oxidation}]{} A \xrightarrow[\text{NaOH}]{} B \xrightarrow{\text{Sodalime}} C$ **then 'C' is**

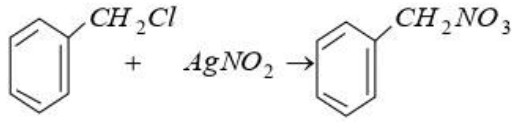
A) C_6H_6 B) C_6H_5OH C) $C_6H_5COONa^+$ D) C_6H_5ONa

57. **Which one of the following is a free-radical substitution reaction?**

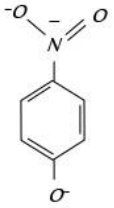
A) $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

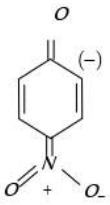
B) 

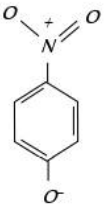
C) 

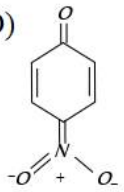
D) 

58. **The most unlikely representation of resonance structures of p-nitrophenoxide(Q) ion is**

A) 

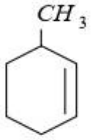
B) 

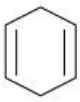
C) 

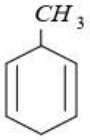
D) 

59. **Which one of the following on ozonolysis followed by oxidation will give adipic acid?**

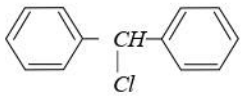
A) 

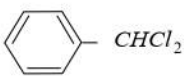
B) 

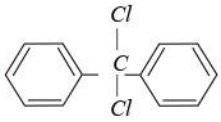
C) 

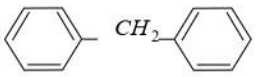
D) 

60. **Which of the following structures correspond to the product expected, when excess of C_6H_6 reacts with CH_2Cl_2 in presence of anhydrous $AlCl_3$**

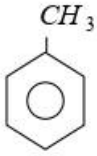
A) 

B) 

C) 

D) 

61. **Which of the following will be easily nitrated?**

A) 

B) 

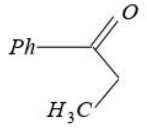
C) CH_3NO_2 D) $C_6H_5NO_2$

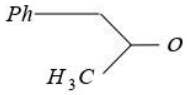
62. **Chlorination of benzene is not possible in the following reaction**

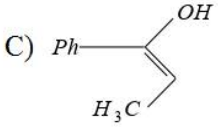
A) $C_6H_6 + Cl_2 \xrightarrow{FeCl_3}$ B) $C_6H_6 + HOCl \xrightarrow{H^+}$

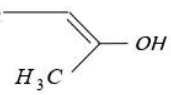
C) $C_6H_6 + I - Cl \xrightarrow{ZnCl_2}$ D) $C_6H_6 + Cl_2 \xrightarrow{AlCl_3}$

63. $Ph - C \equiv C - CH_3 \xrightarrow{Hg^{2+}/H^+} A.$ **'A' is**

A) 

B) 

C) 

D) 

64. **The reagent X in the reactions**

$(CH_3)_3CCH = CH_2 \xrightarrow[THF]{X} Y \xrightarrow[NaOH]{NaBH_4} (CH_3)_3 - C - \underset{\underset{OH}{|}}{C}H - CH_3$

A) H_3O^+ B) $Hg(CH_3COO)_2$ C) OH^- D) $HCOOH$

65. $CH_2 = CH_2 \xrightarrow{Br_2/H_2O} A$, **In this reaction the compound 'A' is**

A) Ethylene bromohydrin B) 1, 2-dibromo ethane

C) Ethanol D) None of these

66. $CH_3 - \underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}} - \underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}} - CH_3 \xrightarrow{(a)\,NaNH_3} x \xrightarrow{(b)\,CH_3I} y$

$CH_3 - C \equiv C - C \equiv C - CH_3$

In the above reaction what is the value of a + b?

A) 10 B) 8 C) 4 D) 7

67. Which of the following is an electrophile?

A) H_2O B) NH_3 C) $AlCl_3$ D) $C_2H_5NH_2$

68. In order to complete the reaction $1-\text{Pentyne} \xrightarrow{a} 4-\text{Octyne} \xrightarrow{b} \text{cis 4 Octene}$, **a and b will be**

	a	**b**
1)	$NaNH_2; CH_3CH_2Br$	: H_2, (one mole) Pd or Ni
2)	$NaNH_2; CH_3CH_2CH_2Br$	: H_2 (two mole) Pd or Ni
3)	$NaNH_2; CH_3CH_2CH_2Br$	: H_2, (one mole) Pd or Ni
4)	$NaNH_2; CH_3CH_2CH_2Br$	: BH_3, H_2O_2, OH^-

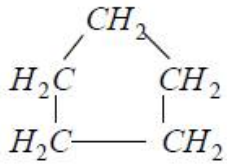
A) 1 B) 2 C) 3 D) 4

69. An alkane molecular weight 72 g forms only one monochlorinated product. Its formula is

A) $(CH_3)_4 C$

B) $CH_3(CH_2)_3 CH_3$

C) $(CH_3)_2 CHCH_2CH_3$

D) 

70. The poisonous gas that comes out with petrol burning in a car is

A) CH_4 B) C_2H_6 C) CO_2 D) CO

SECTION-II
(Numerical Value Answer Type)

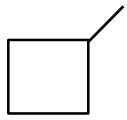
This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

71. The number of secondary hydrogens in 2, 2-dimethyl butane is

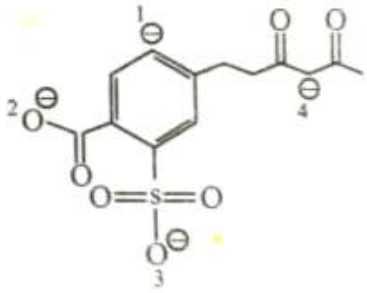
72. How many structures are possible for C_5H_8 with one triple bond?

73. Amount of oxygen consumed in grams for complete combustion of 29g butane?

74. How many distinct monochlorinated products, including stereo-isomers, can result when the alkane below is heated in the presence of Cl_2?



75. Which of the following is the strongest nucleophillic site in the following species?



MELUHA INTERNATIONAL SCHOOL
HYDERABAD

SR MPC | **JEE MAINS MODEL UT-II** | **Date: 02-06-2020**
Time: 3 Hours | **Max. Marks: 300 M**

KEY SHEET

MATHEMATICS

1) **B**	2) **D**	3) **C**	4) **B**	5) **A**	6) **C**	7) **A**	8) **C**	9) **C**	10) **1**
11) **D**	12) **A**	13) **C**	14) **D**	15) **C**	16) **D**	17) **D**	18) **C**	19) **A**	20) **B**
21) **2240**	22) **3**	23) **1**	24) **9.33**	25) **64**					

PHYSICS

26) **D**	27) **C**	28) **B**	29) **C**	30) **A**	31) **A**	32) **A**	33) **D**	34) **C**	35) **D**
36) **A**	37) **C**	38) **B**	39) **C**	40) **C**	41) **A**	42) **C**	43) **A**	44) **D**	45) **C**
46) **3.86**	47) **-19.2**	48) **0.16**	49) **0.18**	50) **7.5**					

CHEMISTRY

51) **A**	52) **C**	53) **A**	54) **C**	55) **A**	56) **A**	57) **B**	58) **C**	59) **B**	60) **D**
61) **A**	62) **B**	63) **A**	64) **B**	65) **A**	66) **B**	67) **C**	68) **C**	69) **A**	70) **D**
71) **2**	72) **3**	73) **104**	74) **8**	75) **1**					

HINTS & SOLUTIONS

MATHEMATICS

1. $\int \frac{(\sin x+\sin 3x)+3(\sin 3x+\sin 5x)+3(\sin 5x+\sin 7x)}{\sin 2x+3\sin 4x+3\sin 6x}\,dx$

$\int \frac{(2\sin 2x\cos x+6\sin 4x\cos x+6\sin 6x\cos x)}{\sin 2x+3\sin 4x+3\sin 6x}\,dx$

$\int \frac{2\cos x(\sin 2x+3\sin 4x+3\sin 6x)}{\sin 2x+3\sin 4x+3\sin 6x}\,dx$

$=2\sin x+c$

2. $I=\int \frac{\sin x}{\sin 4x}\,dx=\frac{1}{4}\int \frac{dx}{\cos x.\cos 2x}$

$=\frac{1}{4}\int \frac{\cos x}{(1-\sin^2 x)(1-2\sin^2 x)}dx$

Putting $t=\sin x$, we get $dt=\cos x.dx$

$I=\frac{1}{4}\int \frac{dt}{(1-t^2)(1-2t^2)}dt=\frac{1}{4}\int\left(\frac{2}{1-2t^2}-\frac{1}{1-t^2}\right)dt$

$=\frac{1}{4}\int \frac{dt}{\frac{1}{2}-t^2}-\frac{1}{4}\int \frac{dt}{1-t^2}$

$=\frac{1}{4}\frac{1}{\sqrt{2}}ln\left|\frac{\frac{1}{\sqrt{2}}+\sin x}{\frac{1}{\sqrt{2}}-\sin x}\right|-\frac{1}{8}ln\left|\frac{1+\sin x}{1-\sin x}\right|+C$

3. $\int \frac{d\theta}{\cos^3\theta\sqrt{\sin 2\theta}}=\int \frac{d\theta}{\cos^4\theta\sqrt{2\tan\theta}}$

$=\int \frac{\sec^2\theta(1+\tan^2\theta)}{\sqrt{2\tan\theta}}d\theta$

$=\frac{1}{\sqrt{2}}\int \frac{1+t^2}{\sqrt{t}}dt$ [put $\tan\theta=t$]

$=\frac{1}{\sqrt{2}}\left(2\sqrt{t}+\frac{t^{5/2}}{5/2}\right)=\frac{\sqrt{2}}{5}\sqrt{\tan\theta}(5+\tan^2\theta)+c$

4. $I=\int \frac{\sin(x-\alpha+\alpha)}{\sin(x-\alpha)}dx$

$=\int \cos\alpha\,dx+\int \frac{\cos(x-\alpha)}{\sin(x-\alpha)}\sin\alpha\,dx$

$=x\cos\alpha+\sin\alpha\log|\sin(x-\alpha)|+C$

5. $\int \frac{5\tan x}{\tan x-2}dx=\int \frac{5\sin x}{\sin x-2\cos x}dx$

$5\sin x=A(\sin x-2\cos x)+B\frac{d}{dx}(\sin x-2\cos x)$

$A(\sin x-2\cos x)+B(\cos x+2\sin x)$

$\left.\begin{matrix}A+2B=5\\-2A+B=0\end{matrix}\right\}A=1,\ B=2$

Now $\int \frac{5\sin x}{\sin x - 2\cos x} dx$

$\int \left(\frac{(\sin x - 2\cos x)}{\sin x - 2\cos x} + \frac{2(\cos x + 2\sin x)}{\sin x - 2\cos x} \right) dx$

$= x + 2\log|\sin x - 2\cos x| + K$

$a = 2$

6. Put $x^3 = t \Rightarrow 3x^2 dx = dt$

$I = \frac{1}{3}\int f(t) t\, dt$

$\frac{1}{3}\left[t\int f(t)\, dt - \int \left(1.\int f(t)\, dt \right) dt \right]$

$= \frac{1}{3} x^3 \psi(x^3) - \int \psi(x^3) x^2\, dx$

7. Here $f\, f(x) = \frac{f(x)}{\left[1 + f(x)^n\right]^{1/n}} = \frac{x}{\left(1 + 2x^n\right)^{1/n}}$ and $f\, f\, f(x) = \frac{x}{\left(1 + 3x^n\right)^{1/n}}$

$\therefore g(x) = (\, fofo.....of\,)(x) = \frac{x}{\left(1 + nx^n\right)^{1/n}}$

Let $I = \int x^{n-2} g(x)\, dx = \int \frac{x^{n-1}}{\left(1 + nx^n\right)^{1/n}}\, dx$

$\frac{1}{n^2}\int \frac{n^2 x^{n-1}}{\left(1 + nx^n\right)^{1/n}}\, dx = \frac{1}{n^2}\int \frac{\frac{d}{dx}\left(1 + nx^n\right)}{\left(1 + nx^n\right)^{1/n}}\, dx$

$= \frac{1}{n(n-1)}\left(1 + nx^n\right)^{1 - \frac{1}{n}} + K$

8. $J - I = \int \left(\frac{e^{-x}}{e^{-4x} + e^{-2x} + 1} - \frac{e^x}{e^{4x} + e^{2x} + 1} \right) dx$

$= \int \frac{e^{3x} - e^x}{e^{4x} + e^{2x} + 1}\, dx = \int \frac{e^x\left(e^{2x} - 1\right)}{e^{4x} + e^{2x} + 1}\, dx$

Let $e^x = t \qquad e^x dx = dt$

$= \int \frac{t^2 - 1}{t^4 + t^2 + 1} dt = \int \frac{1 - 1/t^2}{\left(t + 1/t\right)^2 - 1} dt$

$= \frac{1}{2} ln \left| \frac{t + \frac{1}{t} - 1}{t + \frac{1}{t} + 1} \right| + C = \frac{1}{2} ln \left| \frac{e^{2x} - e^x + 1}{e^{2x} + e^x + 1} \right| + C$

9. Let $I = \int \frac{\sec^2 x}{(\sec x + \tan x)^{9/2}} dx$

$= \int \frac{\sec x(\sec x + \tan x)\sec x}{(\sec x + \tan x)^{11/2}} dx$

Put $\sec x + \tan x = t$

$\Rightarrow (\sec x \tan x + \sec^2 x)\, dx = dt$

Also $\because \sec^2 x - \tan^2 x = 1$

$\Rightarrow \sec x - \tan x = \frac{1}{t}$

$\therefore \sec x = \frac{1}{2}\left(t + \frac{1}{t}\right)$

$\therefore I = \frac{1}{2}\int \frac{\left(1+\frac{1}{t}\right)dt}{t^{11/2}} = \frac{1}{2}.\int \left(t^{-9/2} + t^{-13/2}\right)dt$

$= \frac{1}{2}\left(-\frac{2t^{-7/2}}{7} - \frac{2t^{-11/2}}{11}\right) + K$

$= -\frac{1}{t^{11/2}}\left(\frac{1}{11} + \frac{t^2}{7}\right) + K$

$= -\frac{1}{\left(\sec x + \tan x\right)^{11/2}}\left\{\frac{1}{11} + \frac{1}{7}\left(\sec x + \tan x\right)^2\right\} + K$

10. $\int \frac{dx}{2\left[\sin\left(x + \frac{\pi}{6}\right)\right]}$

$= \frac{1}{2}\int \operatorname{cosec}\left(x + \frac{\pi}{6}\right) dx$

$= \frac{1}{2}\log\left|\tan\frac{x}{2} + \frac{\pi}{12}\right| + C$

11. $I = \int_1^e \left(x+1\right)e^x \ln x\, dx$

$= \int_1^e \left[x\ln x + \ln x + 1 - 1\right]e^x\, dx$

$= \int_1^e \left[\underbrace{x\ln x}_{f(x)} + \underbrace{\ln x + 1}_{f^1(x)}\right]e^x\, dx - \int_1^e e^x\, dx$

$= \left[x\ln x e^x\right]_1^e - \left[e^x\right]_1^e = ee^e - e^e + e$

12. $F\left(x\right) = \int \frac{\sin x}{x} dx$

Now $I = \int_1^3 \frac{\sin 2x}{x} dx \left[\text{put } 2x = t\right]$

$= \int_2^6 \frac{2}{2}\frac{\sin t}{t} dt = \left[F\left(x\right)\right]_2^6 = F\left(6\right) - F\left(2\right)$

13. $f\left(x\right) = \int_2^x \frac{dt}{\sqrt{1+t^4}} \qquad \left[\because\ f\left(2\right) = 0\right]$

$g\left(f\left(x\right)\right) = x$

$g^1\left(f\left(x\right)\right) f^1\left(x\right) = 1$

$g^1\left(0\right) f^1\left(2\right) = 2$

$g^1\left(0\right) = \frac{1}{f^1\left(2\right)} = \sqrt{17}$

$\Rightarrow f^1\left(x\right) = \frac{1}{\sqrt{1+x^4}} \Rightarrow f^1\left(2\right) = \frac{1}{\sqrt{17}}$

14. $I=\int_0^1 \prod_{r=1}^{n}(x+r)\sum_{k=1}^{n}\frac{1}{x+K}dx$

Let $ln\prod_{r=1}^{n}(x+r)=t \Rightarrow \sum_{k=1}^{n}\frac{1}{x+K}dx=dt$

$I=\int_{ln(n!)}^{ln(n+1)!} e^t\,dt=\left[e^t\right]_{ln(n!)}^{ln(n+1)!}$

$=(n+1)!-n!=n.n!$

15. $=\int_0^{\pi}|\sin x|dx+\int_{\pi}^{10\pi}|\sin x|dx-\int_0^{\pi}|\sin x|dx$

$=\int_0^{10\pi}|\sin x|dx-\int_0^{\pi}|\sin x|dx$

$=10\int_{\pi}^{\pi}|\sin x|dx-\int_0^{\pi}|\sin x|dx=9\int_0^{\pi}|\sin x|dx$

$=9 \quad 2=18$

16. $\lim_{n\to\infty}\sum_{r=1}^{n}\frac{r}{n^2}\sec^2\frac{r^2}{n^2}$

$\lim_{n\to\infty}\sum_{r=1}^{n}\frac{1}{n}.\frac{r}{n}\sec^2\frac{r^2}{n^2}$ Put $\frac{1}{n}=dx;\ \frac{r}{n}=x$

Lower limit $x=\frac{r}{n}$

$r=1 \quad x=1/n$

$n\to\infty \ \ x=0$

$r=n \quad x=1$

$=\int_0^1 x\sec^2 x^2dx$

Put $x^2=t;\ 2xdx=dt;\ xdx=\frac{dt}{2}$

$x=0,\quad t=0$

$x=1,\quad t=1$

$=\frac{1}{2}\int_0^1\sec^2 t\,dt$

$=\frac{1}{2}(\tan t)_0^1=\frac{1}{2}\tan 1$

17. $\int_0^{1.5} x\left[x^2\right]dx$

$\int_0^1 0\,dx+\int_1^{\sqrt{2}} x\,dx+\int_{\sqrt{2}}^{1.5}2x\,dx$

$\left[\frac{x^2}{2}\right]_1^{\sqrt{2}}+\left[x^2\right]_{\sqrt{2}}^{1.5}$

$\left(\frac{2}{2}-\frac{1}{2}\right)+(2.25-2)$

$\frac{1}{2}+\frac{1}{4}=\frac{3}{4}$

18. $2I = \int_{-\pi}^{\pi} \cos^2 x\,dx$

$= 2\int_{0}^{\pi} \cos^2 x\ dx$

$\Rightarrow I = \int_{0}^{\pi} \frac{1+\cos 2x}{2}\ dx = \frac{1}{2}\left[x + \frac{\sin 2x}{2} \right]_0^{\pi}$

$I = \frac{\pi}{2}$

19. $f(x) = \frac{e^x}{1+e^x}$ $I_1 = \int_{f(-a)}^{f(a)} xg\left[x(1-x)\right]dx$

$I_2 = \int_{f(-a)}^{f(a)} g\left[x(1-x)\right]dx$

$f(a) = \frac{e^a}{1+e^a},\ f(-a) = \frac{e^{-a}}{1+e^{-a}}$

$\therefore\ f(a) + f(-a) = 1$

$2I_1 = \int_{f(-a)}^{f(a)} xg\left\{x(1-x)\right\}dx + \int_{f(-a)}^{f(a)} \left\{ f(a) + f(-a) - x \right\} g(1-x)(x)\,dx$

$2I_1 = \int_{f(-a)}^{f(a)} g\left\{x(1-x)\right\}dx = I_2$

$\because\ f(a) + f(-a) = 1$

$2I_1 = I_2$

$\frac{I_2}{I_1} = 2$

20. For $0 < x < 1$, $x^2 > x^3$ and

For $1 < x < 2$, $x^3 > x^2$

$\therefore$ for, $0 < x < 1$, $2^{x^2} > 2^{x^3}$ and

for $1 < x < 2$, $2^{x^2} < 2^{x^3}$

$\therefore \int_0^1 2^{x^2}\,dx > \int_0^1 2^{x^3}\,dx$ and $\int_1^2 2^{x^2}\,dx < \int_1^2 2^{x^3}\,dx$

$\therefore\ I_1 > I_2$ and $I_3 < I_4$

21. $f^{11}(x) = x^{-3/2}$

$f^{1}(x) = \frac{x^{-3/2+1}}{-3/2+1} + c$

$= \frac{x^{-1/2}}{-1/2} + c$

$f^{1}(x) = -\frac{2}{\sqrt{x}} + c$

$f^{1}(4) = -\frac{2}{2} + c = 2$

$\Rightarrow c = 3$

$f^1(x) = -\frac{2}{\sqrt{x}} + 3$

$f(x) = -4\sqrt{x} + 3x + k$

$f(0) = 0 \Rightarrow k = 0$

$f(x) = -4\sqrt{x} + 3x$

$f(784) = -4\sqrt{784} + 3(784)$

$= -112 + 2352 = 2240$

22. $\int \frac{f(x)dx}{x^2(x+1)^3} = \int \left(\frac{1}{x^2} - \frac{x}{(x+1)^3} \right) dx$

$\int \frac{f(x)dx}{x^2(x+1)^3} = \int \frac{3x^2+3x+1}{x^2(x+1)^3} dx$

$\Rightarrow f(x) = 3x^2 + 3x + 1$

$f^1(0) = 3$

23. $F(x) = 3\sin x + 2\cos x + c$

$1 = 3 + c \Rightarrow c = -2$

$F(x) = 3\sin x + 2\cos x - 2$

$F\left(\frac{\pi}{2}\right) = 3 - 2 = 1$

24. $\int_{-2}^{3} \left|1 - x^2\right| dx$

$1 - x^2 > 0 \Rightarrow x^2 - 1 < 0$

$(x+1)(x-1) < 0$

$\Rightarrow x \in [-1,1]$

$1 - x^2 < 0 \Rightarrow x < -1 \text{ or } x > 1$

$\int_{-2}^{-1} -(1-x^2)dx + \int_{-1}^{1} (1-x^2)dx + \int_{1}^{3} -(1-x^2)dx$

$= \left[-x + \frac{x^3}{3} \right]_{-2}^{-1} + \left[x - \frac{x^3}{3} \right]_{-1}^{1} + \left[-x + \frac{x^3}{3} \right]_{1}^{3}$

$\left(1 - \frac{1}{3}\right) - \left(2 - \frac{8}{3}\right) + \left(1 - \frac{1}{3}\right) - \left(-1 + \frac{1}{3}\right) + (-3+9) - \left(-1 + \frac{1}{3}\right)$

$= \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + 6 + \frac{2}{3} = \frac{10}{3} + 6 = \frac{28}{3} = 9.33$

25. $F(x) = \int \frac{e^{\sin x}}{x} dx$

$\int_{1}^{4} \frac{3}{x} e^{\sin x^3} dx \qquad x^3 = t$

$3x^2 dx = dt$

$\int_{1}^{64} \frac{3}{x} . e^{\sin t} . \frac{dt}{3x^2}$

$\int_{1}^{64} \frac{e^{\sin t}}{v} dt = F(64) - F(1)$

$= F(k) - F(1)$

$\therefore k = 64$

PHYSICS

26. $\in_{net} = \dfrac{\in_1 r_2 + \in_2 r_1}{r_1 + r_2}$

$R = \dfrac{r_1 r_2}{r_1 + r_2} + 10$

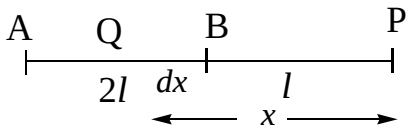
$i = \dfrac{\in_{net}}{R}$

$V = i \times 10$

27. $\dfrac{V}{l} = \left(\dfrac{\in}{R + R_s + r} \right) \dfrac{R}{L}$

28. Use series and parallel combination of capacitors

29.



$dV = \dfrac{1}{4\pi\varepsilon_0} \dfrac{dq}{x}$

$dq = \dfrac{Q dx}{2l}$

$dV = \dfrac{1}{4\pi\varepsilon_0} \dfrac{Q dx}{2lx}$

Integrating on both sides $V = \dfrac{1}{4\pi\varepsilon_0} \dfrac{Q}{2l} \int_l^{3l} \dfrac{1}{x}$

$V = \dfrac{1}{4\pi\varepsilon_0} \dfrac{Q}{2l} ln(3)$

30. $\rho(r) = \rho_0 \left(1 - \dfrac{r}{R} \right)$

$\rho = \dfrac{dq}{dV}$

$dq = \rho dV$

$V = \dfrac{4}{3}\pi r^3$

$dV = 4\pi r^2 dr$

$dq = \rho_0 \left(1 - \dfrac{r}{R} \right) 4\pi r^2 dr$

$dq = 4\pi\rho_0 \left(r^2 - \dfrac{r^3}{R} \right) dr$

Integrating on both sides, Then $E = \dfrac{1}{4\pi\varepsilon_0} \dfrac{q}{r^2}$

31. $\dfrac{1}{4\pi\varepsilon_0} \dfrac{q^2}{x^2} = mg \tan\theta$

$$\frac{1}{4\pi\varepsilon_0}\frac{q^2}{x^2}=mg\frac{x}{2L}$$

$$x=\left[\frac{Q^2 2L}{4\pi\varepsilon_0 mg}\right]^{1/3}$$

32. Since $\bar{p}.\bar{r}=0$

$\bar{E}$ must be antiparallel to $\bar{p}$

So, $\bar{E}=-\lambda\bar{p}$

λ is orbitary constant

$\bar{A}=ai+bj+ck$

$\bar{A}\parallel\bar{E}$

$$\frac{a}{\lambda}=\frac{b}{3\lambda}=\frac{c}{-2\lambda}=k$$

So, $\bar{A}=\lambda k\left(i+3j-2k\right)$

33. $$\frac{V^2}{2R}=60$$

$$\frac{V^2}{R}=120 \quad \text{\_\_\_\_\_}(1)$$

$$\frac{V^2}{R_{eff}}=\frac{2V^2}{R}=2\times120=240\,\text{W}$$

34. $$\frac{5}{1000}=\frac{V_p}{1200}$$

$V_p=6$

$$R_p=\frac{V_p}{I}=\frac{6}{60\times10^{-3}}=100\,\Omega$$

35. Slope of graph give capacitance slope will be more in parallel combination in parallel $50\,\mu F$, in series $8\,\mu F$ when $40\,\mu F$ and $10\,\mu F$

36. $q_A=+\sigma 4\pi a^2$, $q_B=-\sigma 4\pi b^2$, $q_c=+\sigma 4\pi c^2$

$$V_B=\frac{1}{4\pi\varepsilon_0}\left[\frac{q_A}{b}+\frac{q_B}{b}+\frac{q_C}{c}\right]$$

37. $$\frac{X}{R}=\frac{l}{100-l}$$

In first case $\frac{R_L}{R_n}=\frac{60}{40}$ _____(1)

But $R\ \alpha\ l^2$

$$l_2=l_1+\frac{20}{100}l_1=\frac{6}{5}l_1$$

$$\frac{R_1}{R_2}=\frac{l_1^2}{l_2^2}$$

$$R_2=\frac{36}{25}R_1$$

Initial resistance R_n

Final resistance $R_n^1=R_2=\frac{36}{25}R_1$

$\frac{R_L}{R_n^1}=\frac{l^1}{100-l^1}$, find l^1

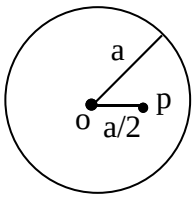
38. $U=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{d}$

39. $F=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$

40. 4 in series, 8 in parallel
$\therefore$ 32

41. Gravitational potential at a point P due to particle O is

$V_1=-\frac{GM}{a/2}$



Gravitational potential due to spherical shell $V_2=-\frac{GM}{a}$

Total potential $V=V_1+V_2$

$=-\frac{GM}{a/2}+\left(-\frac{GM}{a}\right)$

$=-\frac{3GM}{a}$

42. At the equator $g_1=g-R\omega^2$

$W_0=mg_1=m\left(g-R\omega^2\right)$

$=m\left[g-\frac{V^2}{R}\right]$

The speed of the ship relative to the centre of earth $v\pm V$
The weight recorded by spring balance

$W=m\left[g-\frac{\left(v\pm V\right)^2}{R}\right]$

$\frac{W}{W_0}=\left[1-\frac{\left(v\pm V\right)^2}{Rg}\right]\left[1-\frac{v^2}{Rg}\right]^{-1}$

$=\left[1-\frac{\left(v\pm V\right)^2}{Rg}\right]\left[1+\frac{v^2}{Rg}\right]$

$=1-\frac{\left(v\pm V\right)^2}{Rg}+\frac{v^2}{Rg}+....$

$=1\pm\frac{2vV}{g}$

$=1\pm\frac{2\omega V}{g}$

$W=W_0\left[1\pm\frac{2\omega V}{g}\right]$

43. Velocity of rocket offer one minute $v = at = 10 \times 60 = 6 \times 10^2$ m/s

$h = \frac{1}{2} at^2$

$= \frac{1}{2} \times 10 \times 60 \times 60 = 18\,\text{km}$

Total distance $= R + h = 6418\,\text{km}$

From LCE, $\frac{1}{2} mv^2 - \frac{GMm}{R_1} = -\frac{GMm}{R_2}$

$R_2 = 6439.15\,\text{km}$

Final height = $6439.15 - 6400 = 40\,\text{km}$

44. $T = 2\pi \sqrt{\frac{l}{g}}$

$g_{eff} = g\left[\frac{\rho - 1}{\rho}\right]$

$T^1 = T\left[\frac{\rho}{\rho - 1}\right]$

45. Apply LCE for asteroid at a distance 10R and at earth's surface

$k_i = \frac{1}{2} m v_i^2$

$v_i = -\frac{GM_e m}{10R_e}$

$k_f = \frac{1}{2} m v_f^2$

$v_f = -\frac{GM_e m}{R_e}$

$k_i + v_i = k_f + v_f$

$\therefore v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left[1 - \frac{1}{10}\right]$

46. Number of electrons in H_2O molecule $= 2 + 8 = 10$

$q = 10 \times 1.6 \times 10^{-19}$

$q = 16 \times 10^{-19}$

$p = 2d$

$d = \frac{p}{q}$

47. $v = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{d}$

48. $\frac{v}{l} = \left(\frac{\varepsilon}{R + r + R_s}\right)\frac{R}{L}$

49. $v_d = \frac{eE}{m}\tau$

$E = \frac{m v_d}{e\tau}$

$\rho = \frac{m}{ne^2\tau} \Rightarrow \tau = \frac{m}{ne^2\rho}$

$$E = \frac{mv_d}{e\left[\frac{m}{ne^2\rho}\right]} = ne\rho v_d$$

$E = 0.18$ v/m.

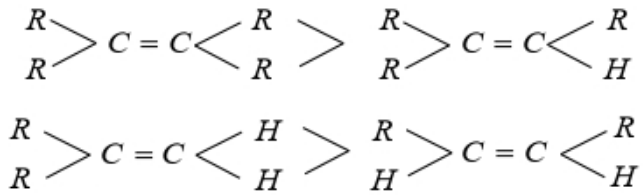
50. Suppose smaller body moves distance x_1 while bigger body moves x_2, till they collide with each other. As their C.M remains stationary $Mx_1 = 5Mx_2$

For touching of two bodies $x_1 + x_2 = 9R$

$x_1 = 7.5R$

CHEMISTRY

51. According to saytzeff rule order of stability is

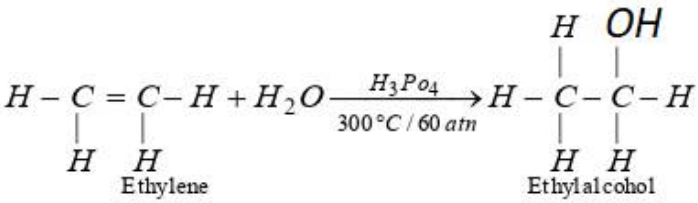


52. On cracking petrol gives smaller hydrocarbons like CH_4, C_3H_6.

53. Cetane is chemically hexadecane i.e., $CH_3(CH_2)_{14}CH_3$

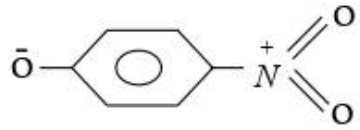
54. In arenes electrophilic substitution reaction takes place and it does not gives electrophilic addition reactions. We also know that benzene is a resonance hybrid of two structure's and greater stability of benzene is due to delocalization of π electron.

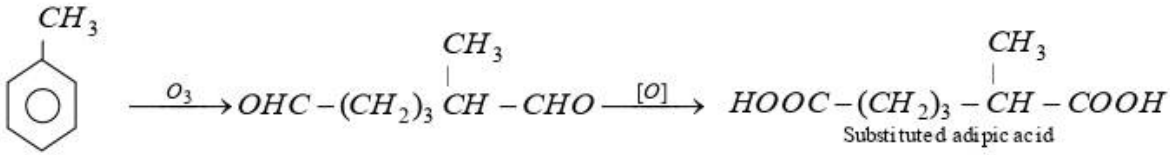
55. Alkenes react with water in the presence of acid and form alcohols. This reaction is called as hydration

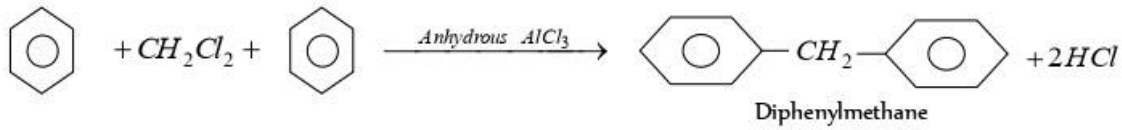


56. $C_6H_5CH_3 \xrightarrow{[O]} \underset{[A]}{C_6H_5COOH} \xrightarrow{NaOH} \underset{[B]}{C_6H_5COONa} \xrightarrow{NaOH/CaO} \underset{[C]}{C_6H_6}$

57. Halogenation of alkyl group proceed via free radical mechanism

58. The structure  is most unlikely as N containing 5 valence electrons should not carry positive charge.

59. 

60. 

61. The presence of an electron-releasing groups (+1 group) e.g. $-CH_3, -OH, -NH_2$ etc. makes the process of nitration easier. So $C_6H_3CH_3$ will be easily nitrated

62. Reaction is called Gattermann-Koch synthesis, which is carried by catalyst $AlCl_3$

63. $C_6H_5-C\equiv C-CH_3 \xrightarrow[H_2SO_4]{HgSO_4} C_6H_5-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$

64. Oxy mereuration-demercuration: with mercuricacetate (in THF) followed by reduction with $NaBH_4/NaOH$ is an example of hydration of alkene according to markowni koff's rule.

$$(CH_3)_3C-CH=CH_2 \xrightarrow[THF]{(CH_3COO)_2Hg} (CH_3)_3C-\underset{\underset{OOCCH_3}{|}}{CH}-CH_2-HgOOCCH_3$$

$$\downarrow NaBH_4/NaOH$$

$$(CH_3)_3C-\underset{\underset{OH}{|}}{CH}-CH_3$$

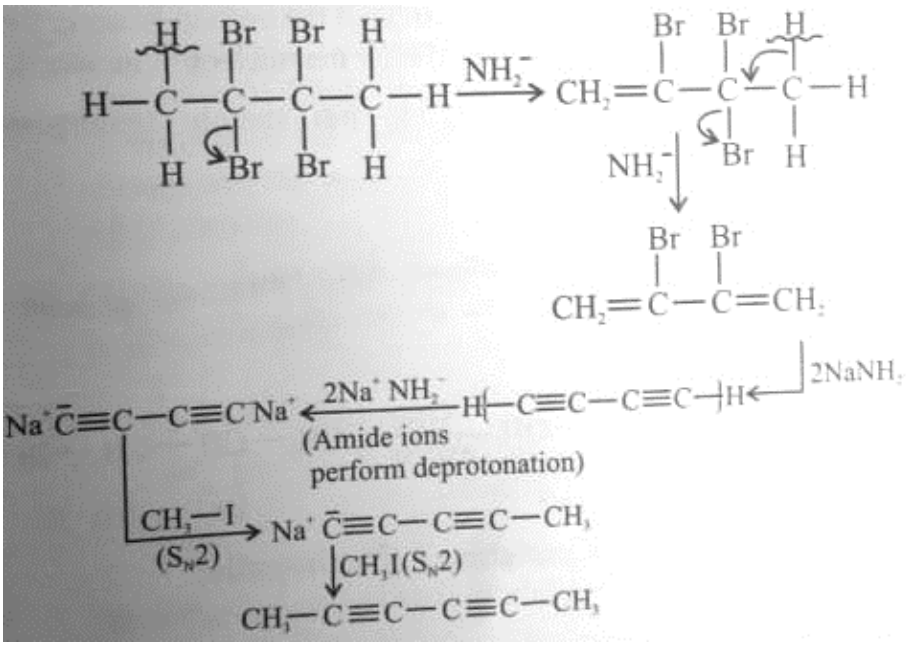
3, 3-Dimethyl-2-butanol

65. $CH_2=CH_2 \xrightarrow{Br_2,H_2O} \underset{\underset{Br}{|}}{CH_2}-\underset{\underset{OH}{|}}{CH_2}$

Ethylene bromohydrin

Hence compound 'A' is Ethylene bromohydrin.

66. NH_2^- is a strong base, it will initiate E_2 elimination here



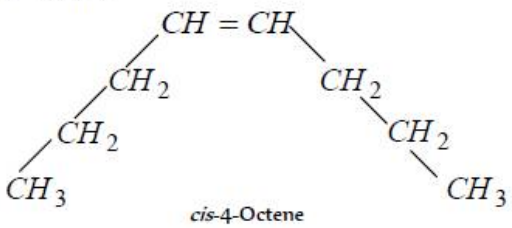
67. $AlCl_3$ is an electron deficient compound. Hence, act as an electrophile

68. $CH_3-CH_2-CH_2-C\equiv CH \xrightarrow{NaNH_2}$

$CH_3-CH_2-CH_2-C\equiv C-Na \xrightarrow{CH_3CH_2CH_2Br}$

$CH_3-CH_2-CH_2-C\equiv C-CH_2-CH_2-CH_3 \xrightarrow[Pd]{H_2}$

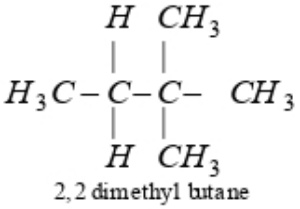
4–Octyne



cis-4-Octene

69. The alkane forms only one mono substituted product, it must have only one type of hydrogen atoms. Therefore the alkane is 2, 2-dimethyl propane.

70. On petrol burning CO comes out which is so much poisonous gas.

71. 
2,2 dimethyl butane

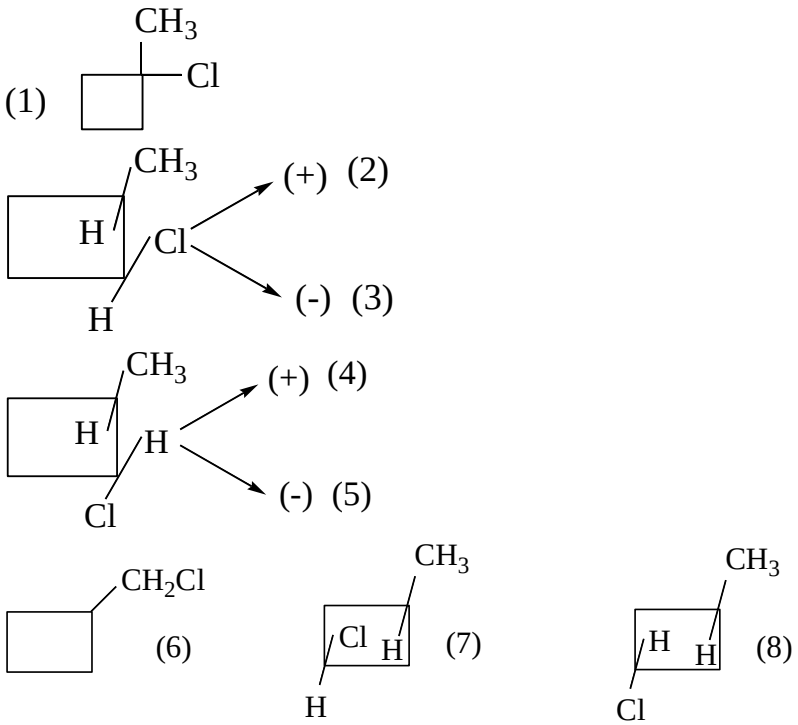
72. $CH_3-\underset{\text{Pent-1-yne}}{CH_2-CH_2-C\equiv CH}$

$CH_3-\underset{\text{Pent-2-yne}}{CH_2-C\equiv C-CH_3}$

$CH_3-\underset{\text{3–Methyl but-1-yne}}{\overset{\overset{CH_3}{|}}{C}H-C\equiv CH}$

73. $C_4H_{10}+\frac{13}{2}O_2 \rightarrow 4CO_2+5H_2O+\text{Heat}$

For 58g of butane 208g oxygen is required for complete combustion. For 29g of butane 104 g oxygen will be consumed

74. 

75. Here, the negative charge is not delocalized. Also negative charge is resting on ‘C’ rather than ‘O’

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