



ADITYA JUNIOR COLLEGES

KAKINADA - RAJAMAHENDRAVARAM - BHIMAVARAM - AMALAPURAM - PALAKOL
TADEPALLIGUDEM - MANDAPETA - NARASAPURAM - VISAKHAPATNAM - SRIKAKULAM

JEE MAINS**Time : 3 Hours****SR_ADV_JEEMAIN_WK-7****DT : 24-06-2023****Max.Marks : 300**

S.No	SECTION	TYPE OF QUESTIONS	No.of Questions	(+VE) MARKS	(-VE) MARKS	EACH SECTION MARKS
1	I	SINGLE ANSWER	60	4	-1	240
2	II	NUMERIC2020	30	4	-1	120
Total Questions		90		Total Marks		360

MATHEMATICS

SECTION - I

1 The number of rational terms in the expansion of $(\sqrt{2} + \sqrt[3]{3} + \sqrt[6]{5})^{10}$ is equal to

- 1) 0 2) 1 3) 2 4) 3

2 If $S_n = \sum_{r=0}^n \frac{1}{nC_r}$ and $T_n = \sum_{r=1}^n \frac{r}{nC_r}$ then $\frac{T_n}{S_n}$ is equal to

- 1) $n - 1$ 2) $\frac{n}{2}$ 3) n 4) $\frac{n}{2} - 1$

3 If in the expansion of $\left(2^x + \frac{1}{4^x}\right)^n$, $n \in \mathbb{N}$ $\frac{T_3}{T_2} = 7$ and sum of the coefficients of 2nd and 3rd terms is 36, then the value of X is equal to (T_i denote the i^{th} term of expansion)

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

4 If the coefficients of x^3 and x^4 in the expansion of $(1 + ax + bx^2)(1 - 2x)^{18}$ in powers of x are both zero, then (a, b) is equal to

- | | |
|--------------------------|--------------------------|
| 1) $(16, \frac{272}{3})$ | 2) $(16, \frac{251}{3})$ |
| 3) $(14, \frac{251}{3})$ | 4) $(14, \frac{272}{3})$ |

5 If there are three successive coefficients in the expansion of $(1 + 2x)^n$ which are in the ratio 1:4:10, then ' n ' is equal to

- 1) 7 2) 8 3) 9 4) 10

6 The coefficient of x^{64} in the expansion of $(1 + x)^{131}(x^2 - x + 1)^{130}$ is

- | | |
|---------------------|--------------------------------------|
| 1) ${}^{130}C_{21}$ | 2) ${}^{130}C_{21} + {}^{130}C_{20}$ |
| 3) 0 | 4) ${}^{129}C_{19} + {}^{129}C_{20}$ |

7 If $2(1 + x^3)^{100} = \sum_{r=0}^{100} (a_r x^r - \cos(\frac{\pi}{2}(x + r)))$, then the value of

$a_0 + a_2 + a_4 + \dots + a_{100}$ is equal to :

- 1) 2^{100} 2) 2^{101} 3) $2^{100} + 50$ 4) $2^{100} - 50$

8 $\sum_{k=1}^6 \left[\sin\left(\frac{2k\pi}{7}\right) - i \cos\left(\frac{2k\pi}{7}\right) \right] =$

1) -1**2)** 0**3)** -i**4)** i

9 If α is an n^{th} root of unity, then $1 + 2\alpha + 3\alpha^2 + \dots + n\alpha^{n-1} =$

1) $\frac{n}{1-\alpha}$

2) $\frac{-n}{1-\alpha}$

3) $\frac{-n}{(1-\alpha)^2}$

4) $\frac{n}{(1-\alpha)^2}$

10 If $x_n = \cos \frac{\pi}{2^n} + i \sin \frac{\pi}{2^n}$, then $\prod_{n=1}^{\infty} x_n =$

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

11 If the line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at A and B , and if $P \equiv (\sqrt{3}, 0)$ then $PA \cdot PB$ is equal to :

1) $\frac{2(\sqrt{3}+2)}{3}$

2) $\frac{4\sqrt{3}}{2}$

3) $\frac{4(2-\sqrt{3})}{3}$

4) $\frac{4(\sqrt{3}+2)}{3}$

12 The points of contact Q and R of tangent from the point $P(2, 3)$ on the parabola $y^2 = 4x$ are :

1) (9, 6) and (1, 2)

2) (1, 2) and (4, 4)

3) (4, 4) and (9, 6)

4) (9, 6) and $\left(\frac{1}{4}, 1\right)$

13 Tangents are drawn from the points on the line $x - y + 3 = 0$ to parabola $y^2 = 8x$ then the variable chords of contact pass through a fixed point whose co-ordinates are

1) (3, 2)

2) (2, 4)

3) (3, 4)

4) (4, 1)

14 If the equation of the parabola, whose vertex is at (5, 4) and the lines directrix is $3x + y - 29 = 0$, is $x^2 + ay^2 + bxy + cx + dy + k = 0$ then $a + b + c + d + k$ is equal to :

1) 575

2) -575

3) 576

4) -576

15 If two tangents drawn from a point P to the parabola $y^2 = 16(x - 3)$ are at right angles, then the locus of point P is :

1) $x + 3 = 0$

2) $x + 1 = 0$

3) $x + 2 = 0$

4) $x + 4 = 0$

16 Let P_1 be a parabola with vertex (3, 2) and focus (4, 4) and P_2 be its mirror image with respect to the line $x + 2y = 6$. Then the directrix of P_2 is $x + 2y = k$. Then the value of k is :

1) 10

2) 14

3) 13

4) 20

17 The area (in sq. units) of an equilateral triangle inscribed in the parabola $y^2 = 8x$, with one of its vertices on the vertex of this parabola, is :

1) $64\sqrt{3}$

2) $256\sqrt{3}$

3) $192\sqrt{3}$

4) $128\sqrt{3}$

18 The straight line $x + y = k$ touches the parabola $y = x - x^2$ if $k = \dots$

1) 0

2) -1

3) 1

4) 2

19 The locus of the mid points of the focal chords of the parabola $y^2 = 4ax$ is :

1) $y^2 = 2a(x + a)$

2) $y^2 = 2a(x - a)$

3) $y^2 = a(2x + a)$

4) $y^2 = a(2x - a)$

- 20** The area of triangle formed by tangents and the chord of contact from $(3, 4)$ to $y^2 = 2x$ is :
- 1) $10\sqrt{10}$
 - 2) $2\sqrt{10}$
 - 3) $\frac{10\sqrt{10}}{3}$
 - 4) $3\sqrt{10}$

SECTION - II

- 21** The value of $\left\{ \frac{3^{2020}}{28} \right\}$, where $\{\cdot\}$ denotes the fractional part function is equal to $\frac{p}{q}$, where p and q are relatively prime natural numbers, then $p + q$ is equal to
- 22** The number rational terms in the expansion of $\left(\sqrt[3]{7} + \sqrt[9]{11} \right)^{6561}$ is equal to :
- 23** If the number of terms in the expansion of $\left(2 + \frac{1}{x} + \frac{1}{x^2} \right)^n$ is 13, then the sum of the coefficients is equal to
- 24** Find the x in the binomial $\left(2^{\frac{1}{3}} + 3^{\frac{1}{3}} \right)^x$ if the ratio of 7th term from the beginning of binomial expansion to 7th term from its end is $\frac{1}{6}$ ($x \in N$).
- 25** If $1, \alpha_1, \alpha_2, \dots, \alpha_{n-1}$ are the n^{th} roots of unity and n is an odd natural number then $(1 + \alpha_1)(1 + \alpha_2)\dots(1 + \alpha_{n-1}) =$
- 26** The lines $2x + y = k$ is a normal to $y^2 = 12x$ then $k =$
- 27** Tangents are drawn from the point $(-1, 2)$ on the parabola $y^2 = 4x$. The length of these tangents will intercept on the line $x = 2$ is AB then $\frac{AB}{\sqrt{2}}$.
- 28** M is the foot of the perpendicular from a point P on the parabola $y^2 = 8(x - 3)$ to its directrix and S is the focus of the parabola and SPM is an equilateral triangle. Then the length of each side of the triangle is :
- 29** If the focus of the parabola $x^2 - ky + 3 = 0$ is $(0, 2)$ then the sum of the values of k is
- 30** Tangent are drawn at those point on the parabola $y^2 = 16x$ whose ordinate are in the ratio 4:1. If the locus of point of intersection of these tangents is $y^2 = kx$, then $[k/3]$ is

PHYSICS

SECTION - I

- 31** If the wave length of the incident radiation changes from λ_1 to λ_2 , then the maximum kinetic energy of the emitted photo electrons changes from K_1 to K_2 , then the work function of the emitter surface is
- 1) $\frac{\lambda_1 K_1 - \lambda_2 K_2}{\lambda_2 - \lambda_1}$
 - 2) $\frac{\lambda_1 K_2 - \lambda_2 K_1}{\lambda_1 - \lambda_2}$

3) $\frac{K_2 - K_1}{\lambda_1 K_1 - \lambda_2 K_2}$

4) $\frac{\lambda_2 - \lambda_1}{\lambda_2 K_1 - \lambda_1 K_2}$

32 For a certain metal the threshold frequency is V_0 . If light of frequency $2V_0$ is incident on it the electron come out with a maximum velocity of $4 \times 10^6 m/s$. If light of frequency of $5V_0$ is incident on it the maximum velocity of the photo electron will be :

1) $8 \times 10^6 m/s$

2) $16 \times 10^6 m/s$

3) $2 \times 10^6 m/s$

4) $12 \times 10^6 m/s$

33 A particle is projected horizontally with a velocity $10 m/s$. What will be the ratio of de-Broglie wavelengths of the particle, when the velocity vector makes an angle 30° and 60° with the horizontal

1) $\sqrt{3} : 1$

2) $1 : \sqrt{3}$

3) $2 : \sqrt{3}$

4) $\sqrt{3} : 2$

34 The impact parameter at which the scattering angle is 90° , $z = 79$ and initial energy 10 MeV is :

1) $1.137 \times 10^{-14} m$

2) $1.137 \times 10^{-16} m$

3) $2.24 \times 10^{-17} m$

4) $2.24 \times 10^{-18} m$

35 The ratio of the kinetic energy and the potential energy of electron in the hydrogen atom will be :

1) 1:2

2) -1:2

3) 2:1

4) -2:1

36 If 13.6 eV is the energy required to separate a hydrogen atom into a proton and an electron then its orbital radius is

1) $5.3 \times 10^{-11} m$

2) $5.3 \times 10^{-12} m$

3) $7.6 \times 10^{-13} m$

4) $7.6 \times 10^{-14} m$

37 A particle of mass $4M$ at rest disintegrates into two particles of mass M and $3M$ respectively having no zero velocities. The ratio of de-Broglie wavelength of particle of mass M to that of mass $3M$ will be :

1) 1:3

2) 3:1

3) $1 : \sqrt{3}$

4) 1 : 1

38 A particle is moving 5 times as fast as an electron. The ratio of the de-Broglie wavelength of the particle to that of the electron is 1.878×10^{-4} . The mass of the particle is close to :

1) $4.8 \times 10^{-27} kg$

2) $9.1 \times 10^{-31} kg$

3) $1.2 \times 10^{-28} kg$

4) $9.7 \times 10^{-28} kg$

39 If the de-Broglie wavelength of an electron is equal to 10^{-3} times the wave length of a photon of frequency $6 \times 10^{14} Hz$, then the speed of electron is equal to :

(Speed of light = $3 \times 10^8 m/s$)

Planck's constant = $6.63 \times 10^{-34} J.s$

Mass of electron = $9.1 \times 10^{-31} kg$

1) $1.1 \times 10^6 m/s$

2) $1.7 \times 10^6 m/s$

3) $1.8 \times 10^6 m/s$

4) $1.45 \times 10^6 m/s$

- 40** In a photoelectric experiment ultraviolet light of wavelength 280nm is used with lithium cathode having work function $\phi = 2.5\text{eV}$ if the wavelength of incident light is switched to 400nm, find out the change in the stopping potential.
($h = 6.63 \times 10^{-34}\text{Js}$, $c = 3 \times 10^8\text{ms}^{-1}$)
- 1) 1.3V 2) 1.1V 3) 1.9V 4) 0.6V
- 41** The stopping potential in the context of photoelectric effect depends on the following property of incident electromagnetic radiation :
- 1) Intensity 2) Amplitude 3) Frequency 4) Phase
- 42** The stopping potential for electrons emitted from a photosensitive surface illuminated by light of wavelength 491nm is 0.710V. When the incident wave length is changed to a new value, the stopping potential is 1.43V. The new wavelength is :
- 1) 329nm 2) 400nm 3) 382nm 4) 309nm
- 43** A 2 mW laser operates at a wavelength of 500nm. The number of photons that will be emitted per second is : [Given Planck's constant $h = 6.6 \times 10^{-34}\text{Js}$, speed of light $c = 3.0 \times 10^8\text{m/s}$]
- 1) 5×10^{15} 2) 1.5×10^{16}
3) 2×10^{16} 4) 1×10^{16}
- 44** The energy required to ionise a hydrogen like ion in its ground state is 9 Rydberg's. What is the wavelength of the radiation emitted when the electron in this ion jumps from the second excited state to the ground state ?
- 1) 24.2nm 2) 11.4nm 3) 35.8nm 4) 8.6nm
- 45** The electron in a hydrogen atom first jumps from the third excited state to the second excited state and subsequently to the first excited state. The ratio of the respective wavelengths, λ_1/λ_2 , of the photons emitted in this process is :
- 1) 20/7 2) 27/5 3) 7/5 4) 9/7
- 46** Taking the wavelength of first Balmer line in hydrogen spectrum ($n=3$ to $n = 2$) as 660nm, the wavelength of the 2nd Balmer line ($n = 4$ to $n = 2$) will be :
- 1) 889.2nm 2) 488.9nm 3) 642.7nm 4) 388.9nm
- 47** The binding energy of the electron in a hydrogen atom is 13.6eV, the energy required to remove the electron from the first excited state of Li^{++} is :
- 1) 122.4eV 2) 30.6eV 3) 13.6eV 4) 3.4eV
- 48** In a hydrogen like atom electron make transition from an energy level with quantum number n to another with quantum number $(n-1)$. If $n \gg 1$ the frequency of radiation emitted is proportional to :
- 1) $\frac{1}{n}$ 2) $\frac{1}{n^2}$
3) $\frac{1}{n^3/2}$ 4) $\frac{1}{n^3}$
- 49** The wavelength of the spectral line in the Balmer series of hydrogen atom is $6561\text{ }A^0$. The wavelength of the second spectral line in the Balmer series of singly-ionized helium atom is :
- 1) $1215\text{ }A^0$ 2) $1640\text{ }A^0$ 3) $2430\text{ }A^0$ 4) $4687\text{ }A^0$
- 50** The largest wavelength in the ultraviolet region of the hydrogen spectrum is 122 nm. The smallest wavelength in the infrared region of the hydrogen spectrum (to the nearest integer) is
- 1) 802nm 2) 823nm 3) 1882nm 4) 1648nm

SECTION - II

- 51** A graph is drawn between stopping potential(y-axis) and incident frequency (x-axis). The intercept OA x-axis gives $0.5 \times 10^{15} H$. The K.E of photo electron emitted from the metal when the energy of incident photon is 5 eV is.
- 52** The de-Broglie wavelength of a particle moving with a velocity $2.25 \times 10^8 m/s$ is equal to the wavelength of a photon. the ratio of kinetic energy of the particle to the K.E of photon is (speed of light = 3×10^8 m/s) $\frac{3}{K}$ find K.
- 53** The energy required to excite an electron from $n = 2$ to $n = 3$ energy state is $47.2 eV$. The charge number of the nucleus, around which the electron revolving will be 5K find K = ?
- 54** The number of different wavelengths may be observed in the spectrum from a hydrogen sample if the atoms are excited to third excited state is ?
- 55** An α - particle and a proton are accelerated from rest by a potential difference of 100V. After this, their de-Broglie wavelengths are λ_α and λ_p respectively. The ratio $\frac{\lambda_p}{\lambda_\alpha}$, to the nearest integer, is
- 56** When photon of energy 4.0eV strikes the surface of a metal A, the ejected photoelectrons have maximum kinetic energy $T_A eV$ and de-Broglie wave length λ_A . The maximum kinetic energy of photo electrons liberated from another metal B by photon of energy 4.50 eV is $T_B = (T_A - 1.5)eV$. If the de- Broglie wavelength of these photoelectrons $\lambda_B = 2\lambda_A$, then the work function of metal B is :
- 57** The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6eV fall on it is 4 eV. The stopping potential, in volt, is
- 58** According to Bohr's theory, the time averaged magnetic field at the centre (i.e nucleus) of a hydrogen atom due to the motion of electrons in the n^{th} orbit is proportional to n^{-k} find k : (n = principal quantum number)
- 59** A hydrogen atom makes a transition from $n=2$ to $n=1$ and emits a photon. This photon strikes a doubly ionized lithium atom($z = 3$) in excited state and completely removes the orbiting electron. The least quantum number for the excited state of the ion for the process is :
- 60** A hydrogen atom in its ground state is irradiated by light of wavelength 970 \AA . Taking $hc/e = 1.237 \times 10^{-6} eV \text{ m}$ and the ground state energy of hydro gen atom as -13.6eV, the number of lines present in the emission spectrum is

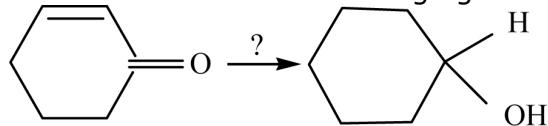
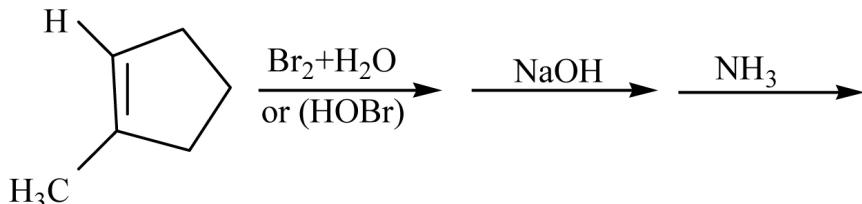
CHEMISTRY

SECTION - I

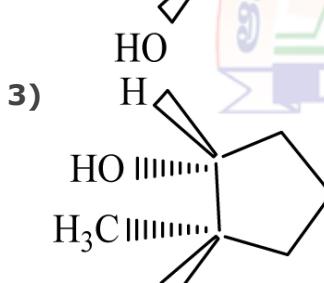
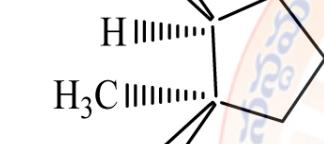
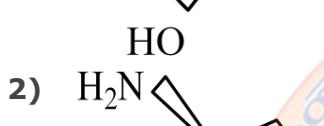
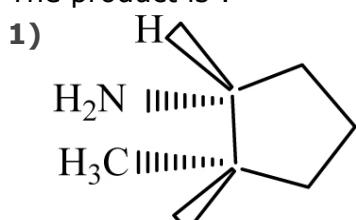
- 61** Identify (Z) in the following series,
- $$\text{Ethanol} \xrightarrow{PBr_3} (X) \xrightarrow{\text{Alc.KOH}} (Y) \xrightarrow[(ii)]{(i)H_2SO_4, \text{Room temp.}} (Z)$$
- 1)** $CH_2 = CH_2$ **2)** $CH_3 - CH_2 - OH$

**62**

Predict the nature of reducing agent in the following reaction.

**1) $LiAlH_4$** **2) $NaBH_4$** **3) H_2/Pt** **4) Both(1) &(3)****63**

The product is :



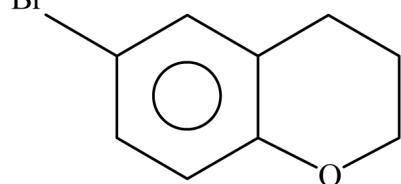
Product.



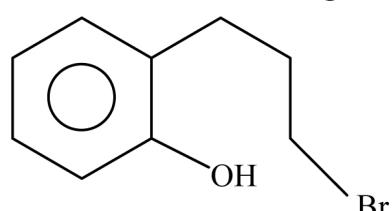
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Find out correct product of reaction :

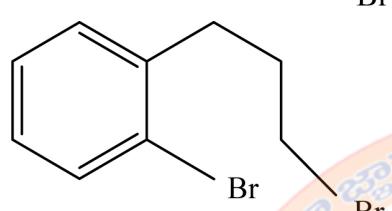
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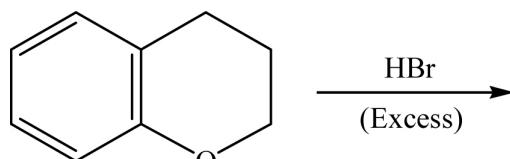
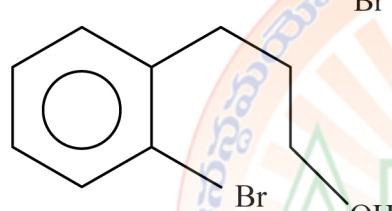
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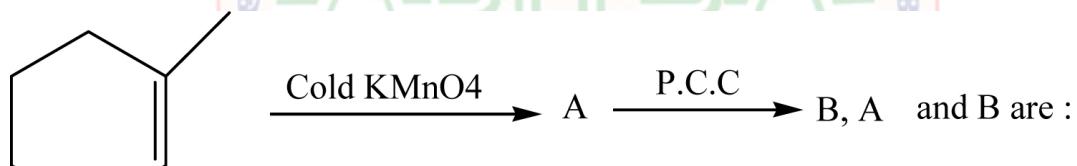
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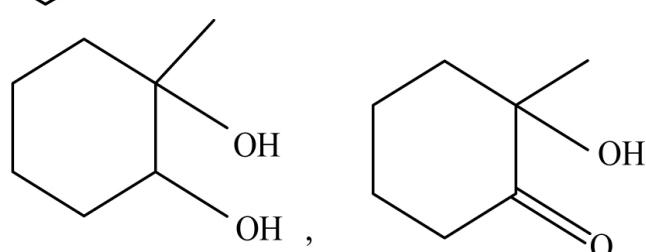
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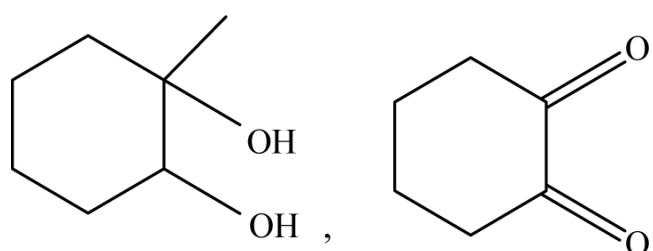
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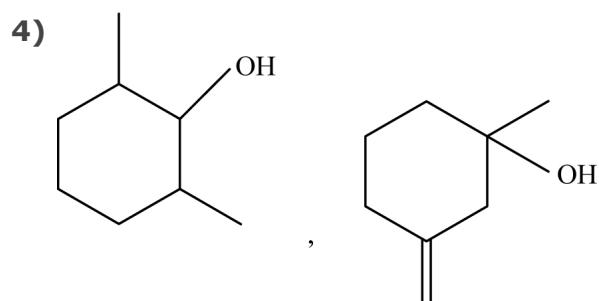
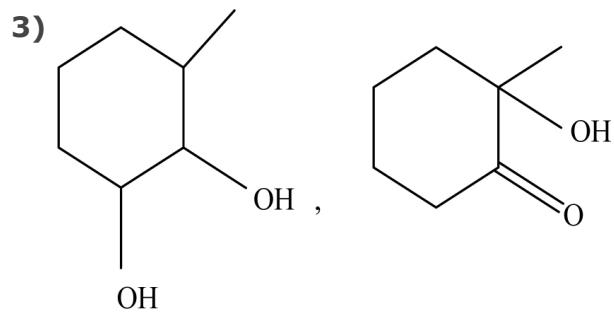


1)

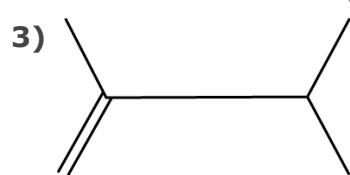
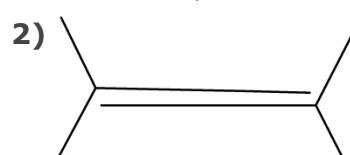
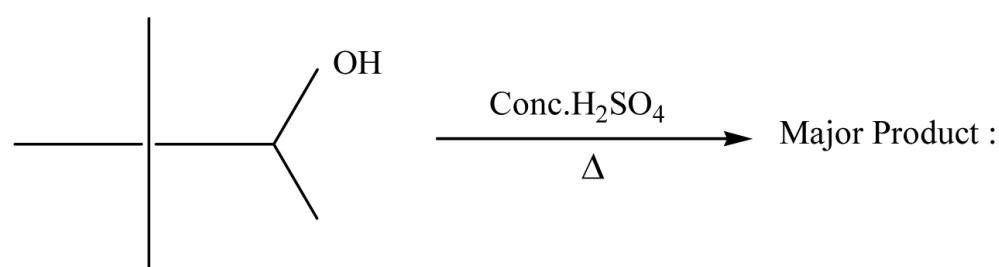


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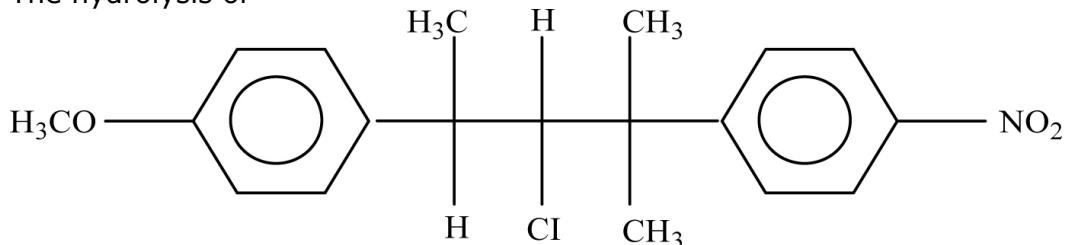
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4) None of these

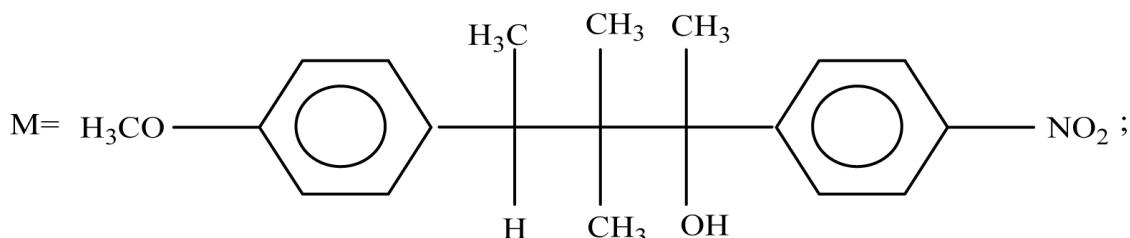
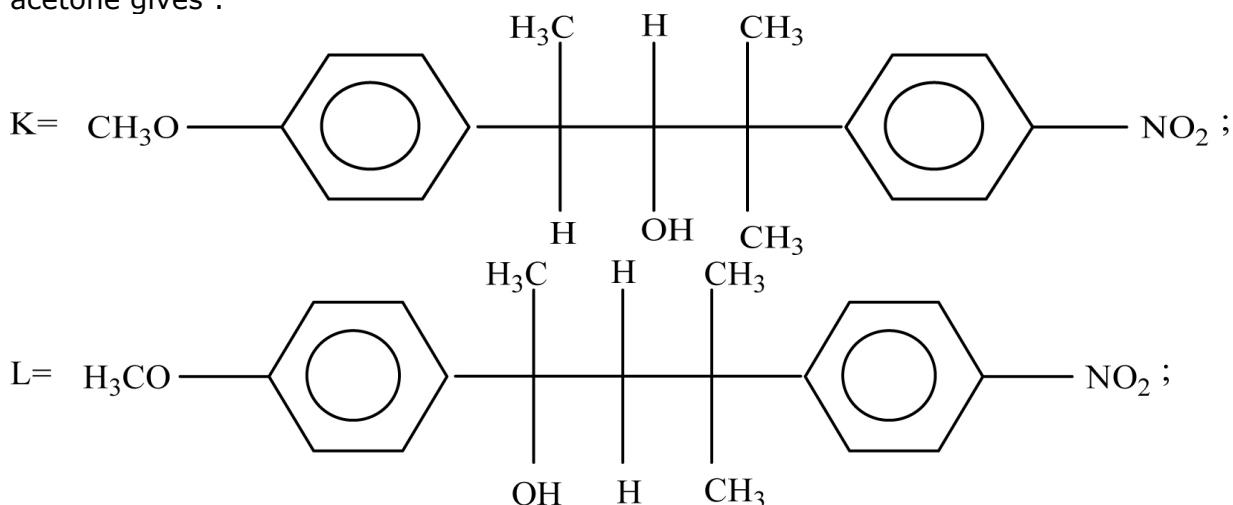
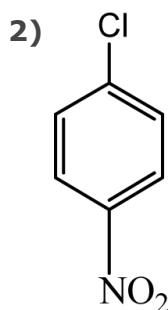
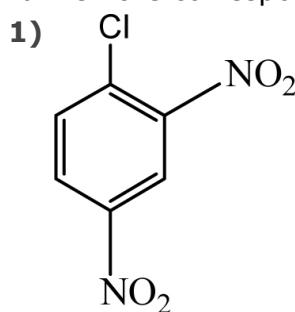
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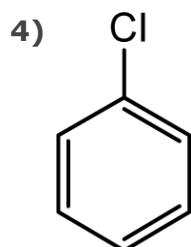
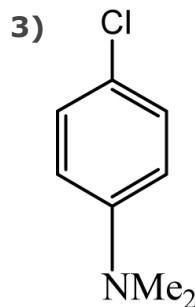
The hydrolysis of



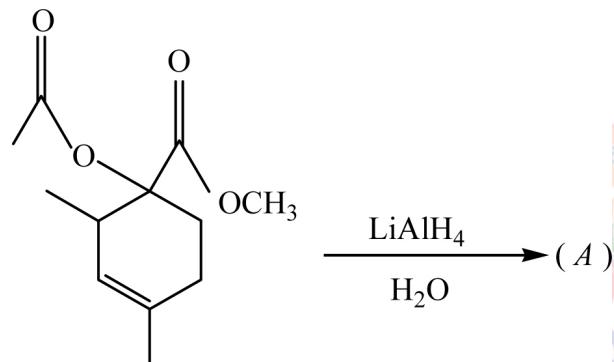
in aqueous

acetone gives :

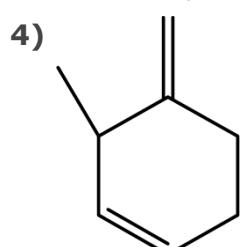
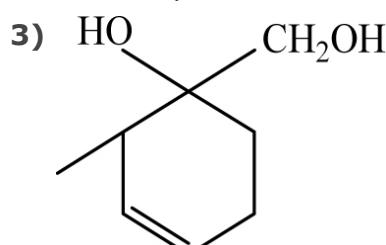
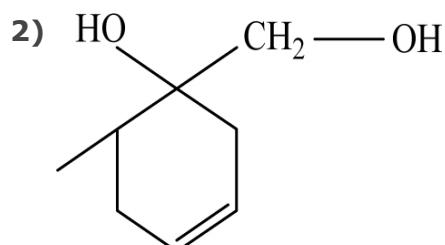
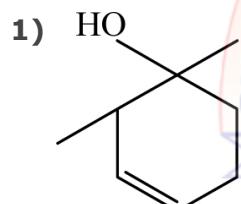
**1)** K and L**2)** Only K**3)** L and M**4)** Only M**68**Which of the following would undergo most rapid hydrolysis with aqueous NaOH to furnish the corresponding hydroxy derivatives ?



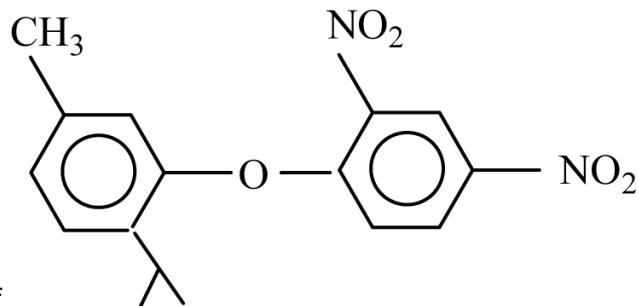
69



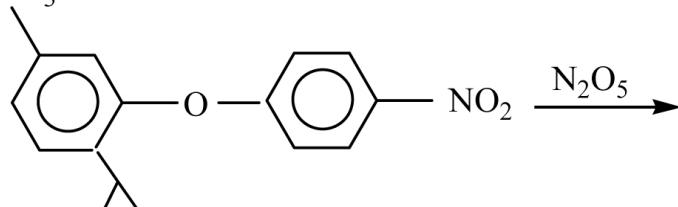
Find out 'A' of the reaction :



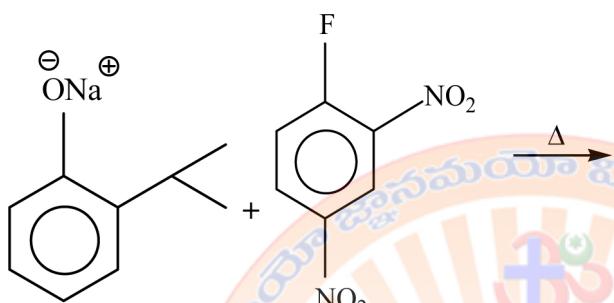
70



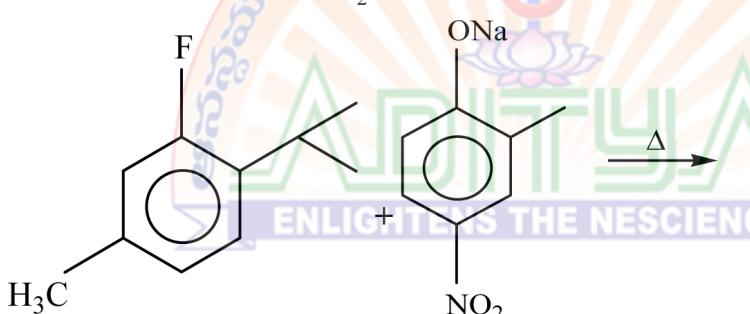
Which is the best synthesis of

1) CH_3 

2)

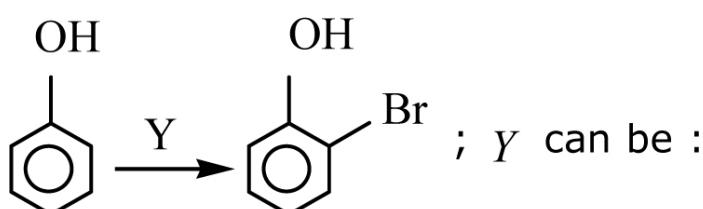


3)



4) all are incorrect

71

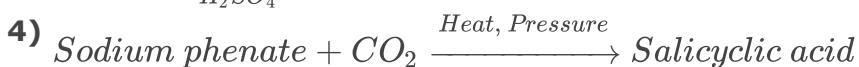
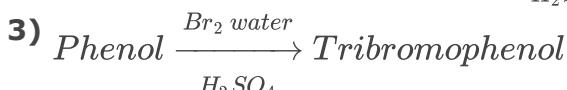
1) Br_2 water2) Br_2/CS_2

3) Both (1) and (2)

4) None

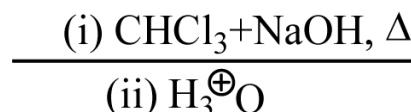
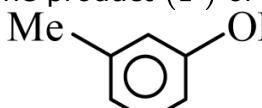
72

Which of the following is not correctly matched?

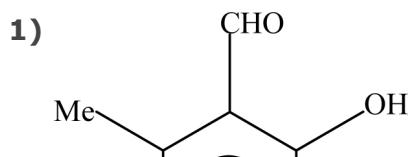


73

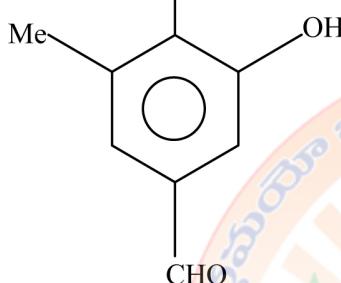
The product (*Y*) of the following sequence of reaction would be



:



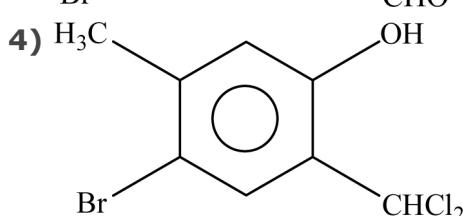
2)



3)

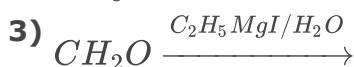
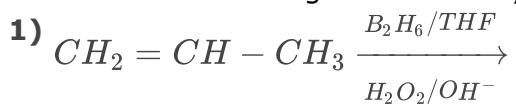


4)



74

Which of the following reaction will yield propan-2-ol?

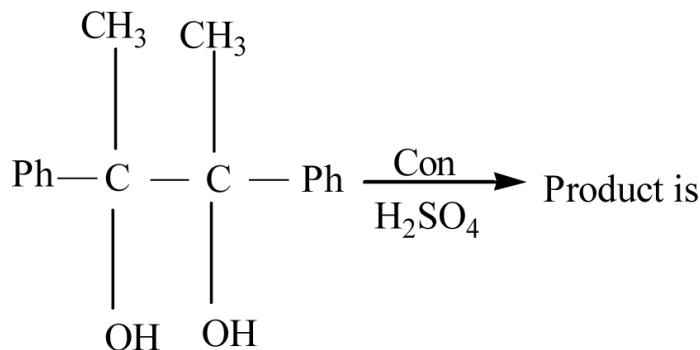


75

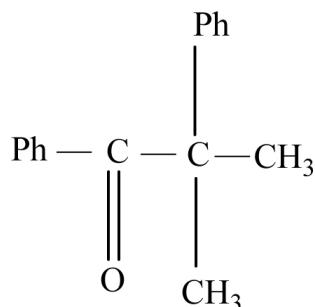
An organic liquid *A* containing *C*, *H* and *O* has a pleasant odour with a b.pt of 78°C . On boiling *A* with conc. H_2SO_4 a colourless gas is produced which decolourises bromine water and alkaline KMnO_4 . One mole of this gas also takes one mole of H_2 . The organic liquid *A* is



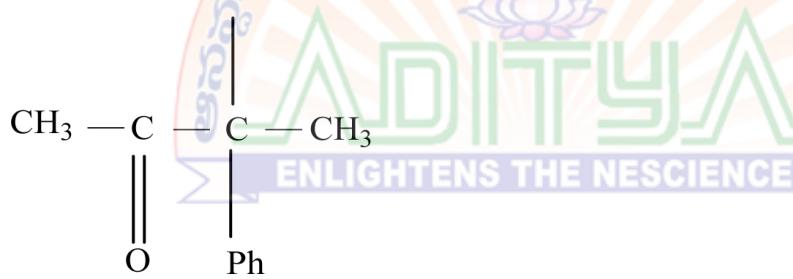
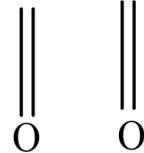
76



1)

2) $\text{Ph} - \text{C} = \text{C} - \text{Ph}$

3)

4) $\text{Ph} - \text{C} = \text{C} - \text{CH}_3$ 

77

Cumene $\xrightarrow[(ii)\text{H}_2\text{O}/\text{H}^+]{(i)\text{O}_2}$ (X) and (Y). (X) and (Y) respectively are :

- 1) toluene, propene
3) phenol, acetone

- 2) toulene, propylchloride
4) phenol, acetaldehyde

78 The most suitable method of separation of equal (1:1) mixture of ortho and para nitrophenols is :

- 1) Crystallisation
3) Sublimation

- 2) Distillation
4) Chromatography

79

Ethers are obtained by

- 1) Reaction of alkyl halide with dry ZnO
3) Reaction of alkyl halide with dry Ag_2O

- 2) Reaction of alkyl halide with moist ZnO
4) Reaction of alkyl halide with moist Ag_2O

80 Assertion (A) : Ethers are relatively inert when compared to alcohols C_2H_5OH

Reason (R) : The hybridization of C and O in $CH_3 - O - CH_3$ is SP^3

- 1) Both A and R are true and R is the correct explanation to A
- 2) Both A and R are true and R is not the correct explanation to A
- 3) A is true but R is false
- 4) A is false but R is true

SECTION - II

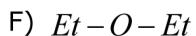
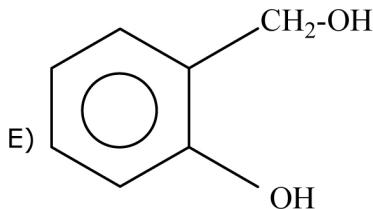
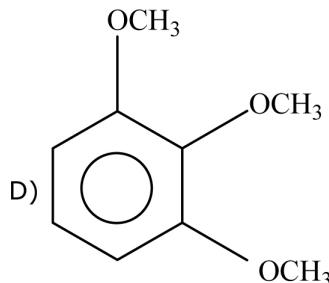
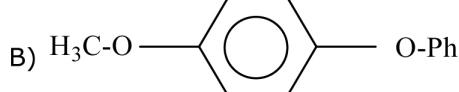
81 $\begin{array}{c} \text{CH}_2 - \text{OH} \\ | \\ \text{C} \text{ H} - \text{OH} \\ | \\ \text{CH}_2 - \text{OH} \end{array}$



(mono halogen derivative)

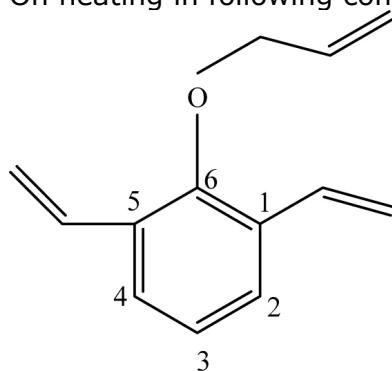
Maximum number of HI molecules that can be used in the above conversion

82 Total number of molecules of HI consumed by all of the reactants will be :



83 0.044g of an alcohol $R - OH$ was added to CH_3MgBr and the gas evolved measured 11.2ml at STP. The molecular mass of $R - OH$ will be :

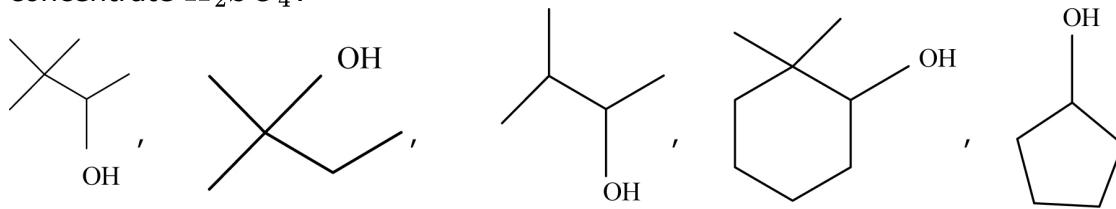
84 On heating in following compound an allyl group will migrate to which position.



85 Find out number of moles of HIO_4 that will react with following compounds.



86 Identify number of alcohols those will show rearrangement during dehydration with concentrate H_2SO_4 .



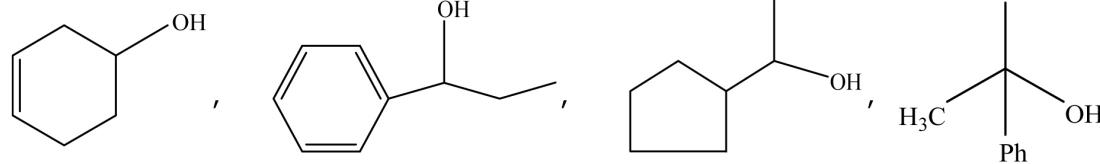
(a)

(b)

(c)

(d)

(e)

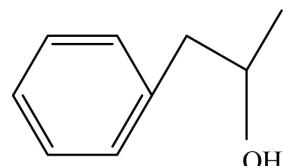


(f)

(g)

(h)

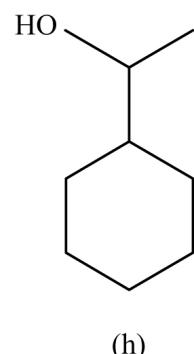
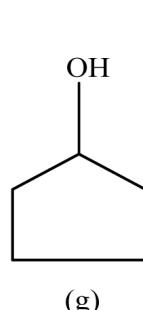
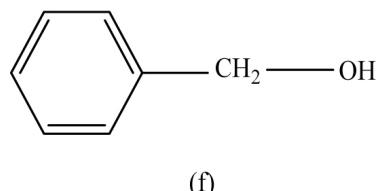
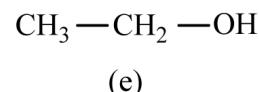
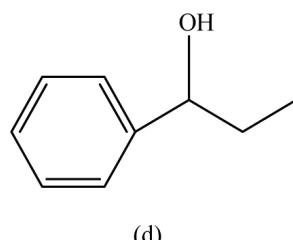
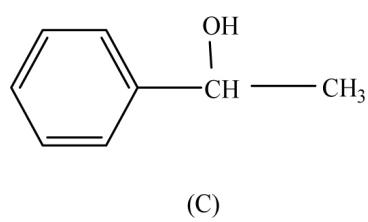
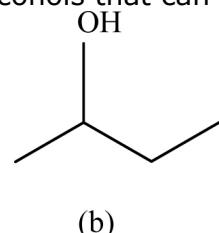
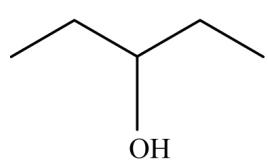
(i)



(j)

87

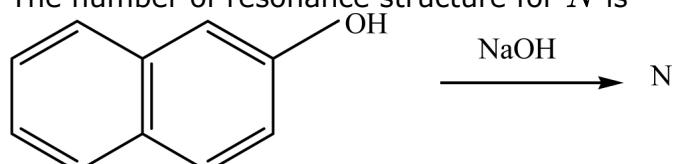
Find out number of alcohols that can give positive iodoform test.

**88**

Total number of isomers, considering both structural and stereoisomers of cyclic ethers with the molecular formula C_4H_8O is

89

The number of resonance structure for N is

**90**

To synthesis one mole of 2-methyl propan-2- ol from ethyl ethanoate _____ equivalents of CH_3MgBr reagent will be required ?