



Max Marks: 60

Date: 10.09.2022

**ARJUNA BATCH
CHEMISTRY: DCT**

Topic: Alcohols, Phenols and Ethers

- $C_2H_4O(A)$ reacts with CH_3MgBr followed by decomposition with H_3O^+ to give 2° alcohol. Thus, A is

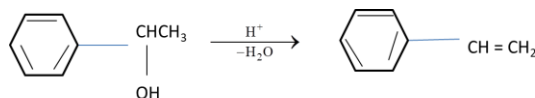
(a) $CH_2=CHOH$ (b) CH_3CHO (c) $\begin{array}{c} CH_2-CH_2 \\ \diagdown \quad \diagup \\ O \end{array}$ (d) None of these
- Boiling point of CH_3CH_2OH (351 K) is much higher than that of isomeric ether $(CH_3)_2O$ (248 K). This indicates.

(a) hydrogen bonds are much stronger intermolecular attractions than dipole-dipole attractions.
 (b) dipole-dipole attractions are much stronger than hydrogen bonds.
 (c) $(CH_3)_2O$ has two hydrophobic groups while CH_3CH_2OH has one.
 (d) $(CH_3)_2O$ has two hydrophilic groups while CH_3CH_2OH has one
- In the following sequence of reactions.

$$CH_3CH_2OH \xrightarrow{P+I_2} A \xrightarrow[\text{Ether}]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D.$$

The compound 'D' is

(a) butanal (b) n-butyl alcohol (c) n-propyl alcohol (d) propanal
- Which of the following statement is correct for the following dehydration of alcohol(A) leading to the formation of styrene (B)?

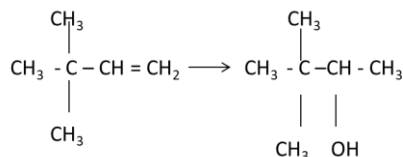


- (A) (B)
- (a) Intermediate is carbocation
 (b) Carbocation is resonance stabilised
 (c) It takes place rapidly
 (d) All above statements are correct.

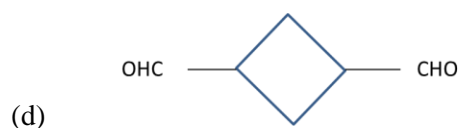
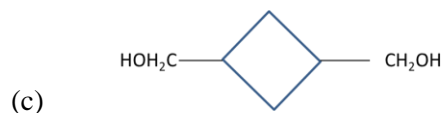
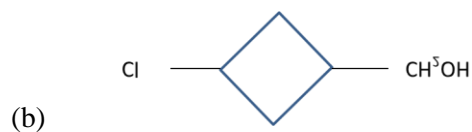
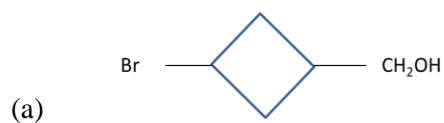
Space for Rough Work



5. An organic compound X on treatment with pyridinium chloro chromate in dichloromethane gives compound Y. Compound Y, reacts with I_2 and alkali to form triiodomethane. The compound X is
- (a) C_2H_5OH (b) CH_3CHO (c) CH_3COCH_3 (d) CH_3COOH



6. The above change can be proceed by
- (a) acid catalyzed hydration (b) oxymercuration –demercuration
(c) hydroboration - oxidation (d) any method mentioned above
7. The dehydration of 2-methyl butanol with conc. H_2SO_4 gives
- (a) 2-methyl butane as major product
(b) pentene
(c) 2-methyl but-2-ene as major product
(d) 2-methyl pent-2-ene.



Space for Rough Work



9. Phenol is heated with a solution of mixture of KBr and KBrO_3 . The major product obtained in the above reaction is

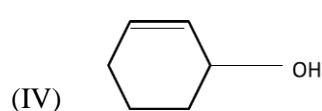
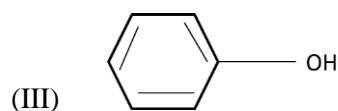
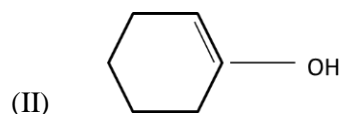
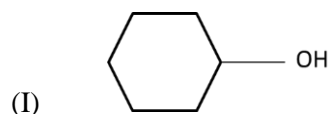
- (a) 2-bromophenol (b) 3-bromophenol
(c) 4-bromophenol (d) 2,4,6-tribromophenol

10. Chlorobenzene $\xrightarrow[\text{X}]{\text{Reaction}}$ Phenol $\xrightarrow[\text{Y}]{\text{Reaction}}$

Salicylaldehyde X and Y reactions respectively are

- (a) Fries rearrangement and Kolbe-Schmidt
(b) Cumene and Reimer-Tiemann
(c) Dow and Reimer-Tiemann
(d) Dow and Friedel-Craft

11. Dehydration of alcohols,



Will be in the order

- (a) $\text{I} < \text{II} < \text{III} < \text{IV}$ (b) $\text{I} > \text{II} > \text{III} > \text{IV}$ (c) $\text{III} < \text{II} < \text{I} < \text{IV}$ (d) $\text{II} < \text{III} < \text{IV} < \text{I}$

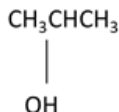
12. One mole of an organic compound A with the formula $\text{C}_3\text{H}_8\text{O}$ reacts completely with two moles of HI to form X and Y. When Y is boiled with aqueous alkali it forms Z. Z answers the iodoform test. The compound A is

- (a) propane-2-ol (b) propane-1-ol (c) ethoxyethane (d) methoxyethane

Space for Rough Work



13. An organic compound containing C, H and O gives red colouration with sodium nitroprusside solution but does not reduce Tollen's reagent and yields chloroform on treating with NaOH and Cl_2 . The compound is



- (a) $\text{CH}_3\text{CH}_2\text{OH}$ (b) CH_3COCH_3 (c) $(\text{CH}_3)_3\text{CH} - \text{CHO}$
14. Which of the following compounds when heated with CO at 150°C and 500 atm pressure in presence of BF_3 forms ethyl propionate?
- (a) $\text{C}_2\text{H}_5\text{OH}$ (b) CH_3OCH_3 (c) $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$ (d) $\text{CH}_3\text{OC}_2\text{H}_5$
15. Phenol on treatment with conc. HNO_3 gives
- (a) picric acid (b) styphnic acid (c) Both a. and b (d) None of these.

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Space for Rough Work



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PART-A

[SINGLE CORRECT CHOICE TYPE]

Q.1 to Q.7 has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct.

Q.1 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

- (A) $\left(16, \frac{272}{3}\right)$ (B) $\left(16, \frac{251}{3}\right)$ (C) $\left(14, \frac{251}{3}\right)$ (D) $\left(14, \frac{272}{3}\right)$

Q.2 The sum of coefficients of integral powers of x in the binomial expansion of $(1 - 2\sqrt{x})^{50}$ is

- (A) $\frac{1}{2}(3^{50} - 1)$ (B) $\frac{1}{2}(2^{50} + 1)$ (C) $\frac{1}{2}(3^{50} + 1)$ (D) $\frac{1}{2}(3^{50})$

Q.3 If the number of terms in the expansion of $\left(1 - \frac{2}{x} + \frac{4}{x^2}\right)^n$, $x \neq 0$, is 28, then the sum of the coefficients of all the terms in this expansion, is

- (A) 729 (B) 64 (C) 2187 (D) 243

Q.4 The value of $({}^{21}C_1 - {}^{10}C_1) + ({}^{21}C_2 - {}^{10}C_2) + ({}^{21}C_3 - {}^{10}C_3) + ({}^{21}C_4 - {}^{10}C_4) + \dots + ({}^{21}C_{10} - {}^{10}C_{10})$ is

- (A) $2^{21} - 2^{11}$ (B) $2^{21} - 2^{10}$ (C) $2^{20} - 2^9$ (D) $2^{20} - 2^{10}$

Q.5 $\int \frac{x^2 - 1}{x^3 \sqrt{2x^4 - 2x^2 + 1}} dx$ is equal to

- (A) $\frac{\sqrt{2x^4 - 2x^2 + 1}}{x^2} + C$ (B) $\frac{\sqrt{2x^4 - 2x^2 + 1}}{x^3} + C$
(C) $\frac{\sqrt{2x^4 - 2x^2 + 1}}{x} + C$ (D) $\frac{\sqrt{2x^4 - 2x^2 + 1}}{2x^2} + C$

Q.6 Let $f(x) = \frac{x}{(1+x^n)^{1/n}}$ for $n \geq 2$ and $g(x) = \underbrace{(f \circ f \circ \dots \circ f)}_{f \text{ occurs } n \text{ times}}(x)$. Then $\int x^{n-2} g(x) dx$ equals

(A) $\frac{1}{n(n-1)} (1+nx^n)^{1-\frac{1}{n}} + K$

(B) $\frac{1}{(n-1)} (1+nx^n)^{1-\frac{1}{n}} + K$

(C) $\frac{1}{n(n+1)} (1+nx^n)^{1+\frac{1}{n}} + K$

(D) $\frac{1}{(n+1)} (1+nx^n)^{1+\frac{1}{n}} + K$

Q.7 Let $I = \int \frac{e^x}{e^{4x} + e^{2x} + 1} dx$, $J = \int \frac{e^{-x}}{e^{-4x} + e^{-2x} + 1} dx$

Then, for an arbitrary constant C, the value of $J - I$ equals

(A) $\frac{1}{2} \ln \left(\frac{e^{4x} - e^{2x} + 1}{e^{4x} + e^{2x} + 1} \right) + C$

(B) $\frac{1}{2} \ln \left(\frac{e^{2x} + e^x + 1}{e^{2x} - e^x + 1} \right) + C$

(C) $\frac{1}{2} \ln \left(\frac{e^{2x} - e^x + 1}{e^{2x} + e^x + 1} \right) + C$

(D) $\frac{1}{2} \ln \left(\frac{e^{4x} + e^{2x} + 1}{e^{4x} - e^{2x} + 1} \right) + C$

PART-B
[MATCHING LIST TYPE]

Q.8 is Matching List type questions. Each question has matching lists. Write your Answer

Q.8 Let $I = \int \frac{e^x}{e^{4x} + 1} dx$ and $J = \int \frac{e^{-x}}{e^{-4x} + 1} dx$

Then for any arbitrary constant C, match the following

Column-I

Column-II

(A) I

(P) $\frac{1}{\sqrt{2}} \tan^{-1} \left(\frac{e^{2x} - 1}{\sqrt{2}e^x} \right) + C$

(B) J + I

(Q) $\frac{1}{2\sqrt{2}} \ln \left(\frac{e^{2x} - \sqrt{2}e^x + 1}{e^{2x} + \sqrt{2}e^x + 1} \right) + C$

(C) J - I

(R)

$\frac{1}{2\sqrt{2}} \left(\tan^{-1} \left(\frac{e^{2x} - 1}{\sqrt{2}e^x} \right) - \frac{1}{2} \ln \left(\frac{e^{2x} - \sqrt{2}e^x + 1}{e^{2x} + \sqrt{2}e^x + 1} \right) \right) + C$

(S)

$\frac{1}{2\sqrt{2}} \left(\tan^{-1} \left(\frac{e^{2x} - 1}{\sqrt{2}e^x} \right) + \frac{1}{2} \ln \left(\frac{e^{2x} - \sqrt{2}e^x + 1}{e^{2x} + \sqrt{2}e^x + 1} \right) \right) + C$



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PART-C **[INTEGER TYPE]**

Q.9 to Q.15 are "Integer Type" questions. (The answer to each of the questions are single digits)

Q.9 If f and g are two real valued functions differentiable over \mathbb{R} such that $f'(x) = g(x) + \frac{x}{f(x)}$ and

$g'(x) + f(x) = \frac{x}{g(x)}$. If $f(1) = 1$ and $g(1) = \sqrt{2}$, then find the value of $f^2(2) + g^2(2)$.

Q.10 If $\int \frac{(2x+3)}{x(x+1)(x+2)(x+3)+1} dx = k - \frac{1}{f(x)}$ where $f(x)$ is of the form $ax^2 + bx + c$, then find the value of $(a+b+c)$.

Q.11 If $I_n = \int \frac{e^{(n+1)x} dx}{\left(1 + e^x + \frac{e^{2x}}{2!} + \dots + \frac{e^{nx}}{n!}\right)} = \lambda_n \left(e^x - \ln(f_n(x))\right) + C$

where $f_n(0) = 1 + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!}$ and C is constant of integration and $g(x) = \lim_{n \rightarrow \infty} \ln(f_n(x))$,

then find the number of real solutions of the equation $g(x) = 4x^2$.



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Q.12 Let $f(x) = \frac{1}{e^x + 8e^{-x} + 4e^{-3x}}$ and $g(x) = \frac{1}{e^{3x} + 8e^x + 4e^{-x}}$. If $\int (f(x) - 2g(x))dx = h(x) + c$,

where c is constant of integration and $\lim_{x \rightarrow \infty} h(x) = \frac{\pi}{4}$, then find the value of $2 \tan(2h(0))$.

Q.13 If $f(x)$ is twice differentiable function from $\mathbb{R} \rightarrow \mathbb{R}$ such that $t^2 f(x) - 2t f'(x) + f''(x) = 0$ has two equal values of t for all x and $f(0) = 1, f'(0) = 2$, then find the value of $\left[\lim_{x \rightarrow 0} \left(\frac{f(x) - 1}{2x} \right)^{\frac{1}{x}} \right]$.

[Note : $[k]$ denotes greatest integer function.]

Q.14 If coefficient of x^{19} in $\sum_{r=0}^{20} (r+1)(x+3)^{20-r}(x+2)^r$ is equal to $\binom{m}{n} \cdot {}^{22}C_n$

where $m, n \in \mathbb{N}$ and $n < 10$ then find the least value of $(m+n)$.

Q.15 When $(3x+5)^{100}$ is expanded, find the largest power of 2 dividing the coefficient of x^{39} .



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ARJUNA BATCH
CHEMISTRY: DCT ANSWER KEY
Topic: Alcohols, Phenols and Ethers.

1.	(b)	2.	(a)	3.	(c)	4.	(d)	5.	(a)
6.	(b)	7.	(a)	8.	(b)	9.	(d)	10.	(c)
11.	(c)	12.	(d)	13.	(c)	14.	(c)	15.	(a)

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ARJUNA BATCH
MATHEMATICS : DCT ANSWER KEY
Topic: Indefinite Integration

16.	(a)	17.	(c)	18.	(Bonus)	19.	(d)	20.	(d)
21.	(a)	22.	(c)	23.	(A-R,B-P,C-Q)	24.	(9)	25.	(5)
26.	(3)	27.	(3)	28.	(2)	29.	(10)	30.	(006)