



VIDYAPEETH ACADEMY

IIT JEE | NEET | FOUNDATION

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JEE Main 2023 (Memory based)

25 January 2023 - Shift 1

Answer & Solutions

CHEMISTRY

1. Radius of 2nd orbit of Li²⁺ ion is x , radius of 3rd orbit of Be³⁺ will be

- A. $\frac{27x}{16}$
- B. $\frac{16x}{27}$
- C. $\frac{4x}{3}$
- D. $\frac{3x}{4}$

Answer (A)

Solution:

$$r_{Li^{2+}} = r_o \times \frac{2^2}{3} = \frac{4r_o}{3} = x \Rightarrow r_o = \frac{3x}{4}$$
$$r_{Be^{3+}} = r_o \times \frac{3^2}{4} = \frac{9r_o}{4} = \frac{9 \times 3 \times x}{4 \times 4} = \frac{27x}{16}$$

2. If X-atoms are present at alternate corners and at body centre of a cube and Y-atoms are present at 1/3rd of face centers then what will be the empirical formula?

- A. $X_{2.5}Y$
- B. X_5Y_2
- C. $X_{1.5}Y$
- D. X_3Y_2

Answer (D)

Solution:

$$\text{No. of X - atoms per unit cell} = 1 + 4 \times \frac{1}{8} = \frac{3}{2}$$

$$\text{No. of Y - atoms per unit cell} = 2 \times \frac{1}{2} = 1$$

Therefore, the empirical formula of the solid is X_3Y_2 .

3. Which of the following option contains the correct match

Table – I (Elements)	Table – II (Flame colour)
A. K	P. Violet
B. Ca	Q. Brick Red
C. Sr	R. Apple Green
D. Ba	S. Crimson Red

- A. A – P, B – Q, C – S, D – R
- B. A – Q, B – P, C – S, D – R
- C. A – R, B – S, C – P, D – Q
- D. A – S, B – R, C – Q, D – P

Answer (A)

Solution:

K – Violet

Ca – Brick Red

Sr – Crimson Red

Ba – Apple Green

4. Match the following

List - I	List - II
A. Pb^{2+}, Cu^{2+}	1. H_2S in dil HCl
B. Fe^{3+}, Al^{3+}	2. NH_4Cl with $(NH_4)_2CO_3$
C. Ni^{2+}, Co^{2+}	3. H_2S in dil NH_4OH
D. Ca^{2+}, Ba^{2+}	4. NH_4Cl with NH_4OH

A. A – 1, B – 2, C – 3, D – 4

B. A – 1, B – 4, C – 3, D – 2

C. A – 4, B – 3, C – 2, D – 1

D. A – 2, B – 1, C – 4, D – 3

Answer (B)**Solution:**

Pb^{2+} and Cu^{2+} will precipitate as PbS and CuS respectively by passing H_2S gas in presence of dil. HCl.

Fe^{3+} and Al^{3+} will precipitate as $Fe(OH)_3$ and $Al(OH)_3$ respectively by adding NH_4Cl and NH_4OH

Ni^{2+} and Co^{2+} will precipitate as NiS and CoS respectively by passing H_2S in presence of dil NH_4OH .

Ca^{2+} and Ba^{2+} will precipitate as $CaCO_3$ and $BaCO_3$ respectively by adding NH_4Cl and $(NH_4)_2CO_3$.

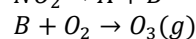
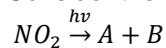
5. Which of the following is correct about antibiotics

A. Antibiotics are the substances that promote the growth of micro-organisms

B. Penicillin has bacteriostatic effect

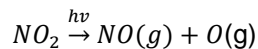
C. Erythromycin has bactericidal effect

D. They are synthesised artificially

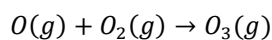
Answer (D)**Solution:** Antibiotics are synthesised artificially.**6. Consider the following sequences of the reactions**

A can be?

A. N_2O B. NO C. N_2O_3 D. N_2

Answer (B)**Solution:**

(A) (B)



(B)

7. Correct order of basic strength in aqueous solution for

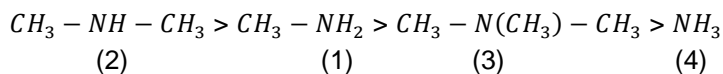
1. $CH_3 - NH_2$
2. $CH_3 - NH - CH_3$
3. $CH_3 - N(CH_3) - CH_3$
4. NH_3

- A. $2 > 1 > 3 > 4$
- B. $3 > 2 > 1 > 4$
- C. $4 > 2 > 1 > 3$
- D. $2 > 4 > 3 > 1$

Answer (A)**Solution:**

Basic strength \propto Availability of lone pairs on Nitrogen atom

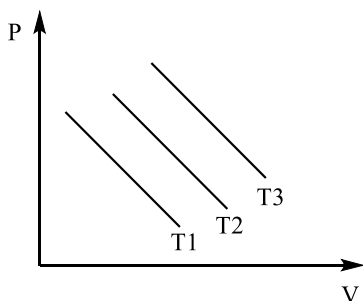
The correct order of basic strength in aqueous medium is



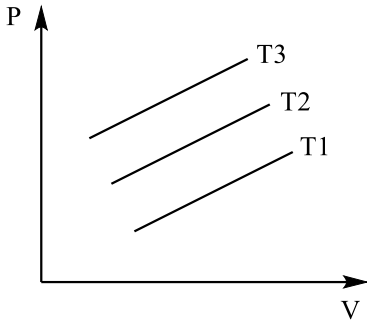
The availability of lone pair on N-atom in case of ammonia and alkyl amines in aqueous medium depend on three factors

- 1) Electron donating effects: +I effect is present in case of alkyl amines but not in case of ammonia and availability of electrons on N-atom \propto +I effect
- 2) Solvation: More is the solvation less will be the availability of electrons on N-atom. Extent of solvation \propto no. of H-atoms directly attach to N-atom
- 3) Steric Crowding: More is no. of alkyl groups more is the steric crowding and less will be the availability of electrons on N-atom

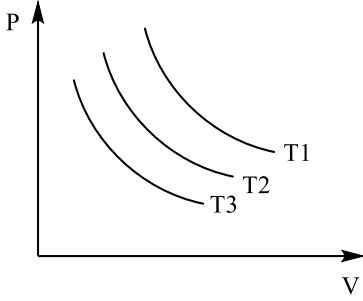
8. Which Graph graph is correct for Isothermal process at T_1, T_2 & T_3 if ($T_3 > T_2 > T_1$)



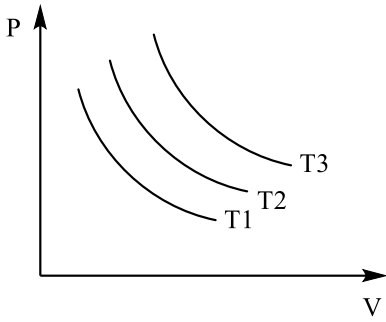
A.



B.



C.



D.

Answer (D)

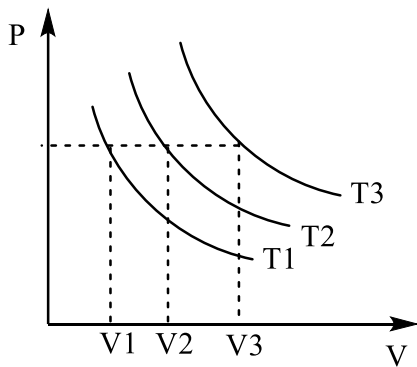
Solution:

According to Boyle Law $P \propto \frac{1}{V}$

The graph must be hyperbola.

As we know, $PV = nRT$

So as increase the Temperature the PV graph area increases



As $(V_3 > V_2 > V_1)$ for fixed P

= $(T_3 > T_2 > T_1)$

And the correct option is (D)

9. An athlete is given 100g of glucose energy equivalent to 1560KJ to utilise 50% of this gained energy in an event. Enthalpy of evaporation of H_2O is 44KJ/mol. In order to avoid storage of energy in the body the mass of water (in g) he would perspire is: (Round off the nearest Integer)

Answer (319)

Solution:

Given 100 g of glucose yields 1560 KJ of energy.

50% of 1560 KJ that is 780 KJ is used to perspire water

To perspire 1 mol of water that is 18 g of water 44 KJ energy is required

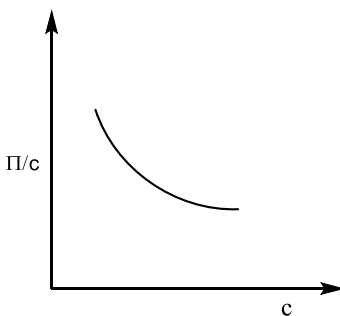
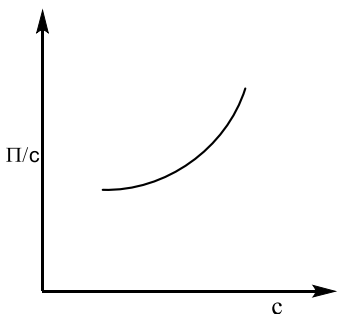
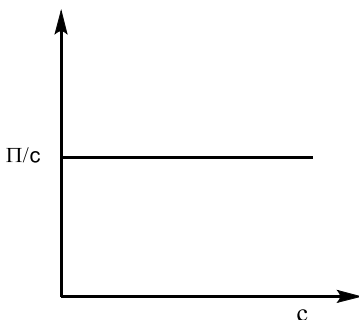
Therefore,

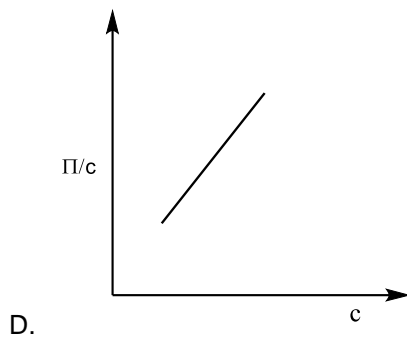
$$\text{Moles of water evaporated} = \frac{780}{44} \text{ mol}$$

$$\text{Weight of water evaporated} = \frac{780}{44} \times 18 = 319 \text{ g}$$

(Assuming water is contained in the body)

10. Which of the following option contains the correct graph between π/c and c at constant temperature (Where π is osmotic pressure and c is concentration of the solute)



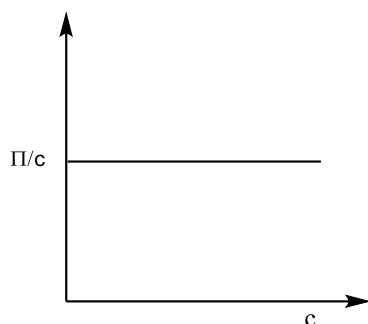


Answer (A)

Solution:

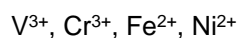
$$\pi = cRT$$

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



The value of $\frac{\pi}{c}$ is constant at constant temperature

11. How many of the following ions/elements has the same value of spin magnetic moment?



Answer (2)

Solution:

V^{3+} - d^2 - 2 unpaired electrons

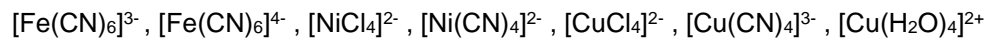
Cr^{3+} - d^3 - 3 unpaired electrons

Fe^{2+} - d^6 - 4 unpaired electrons

Ni^{2+} - d^8 - 2 unpaired electrons

V^{3+} and Ni^{2+} has the same number of unpaired electrons and hence has the same value of spin magnetic Moment.

12. How many of the following complexes is (are) paramagnetic?



Answer (4)

Solution:

$[\text{Fe}(\text{CN})_6]^{3-}$ - d^5 - paramagnetic

$[\text{Fe}(\text{CN})_6]^{4-}$ - d^6 - diamagnetic

$[\text{NiCl}_4]^{2-}$ - d^8 - paramagnetic

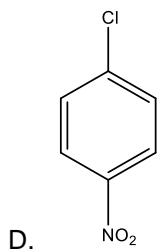
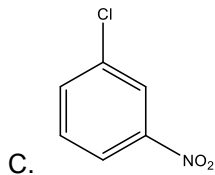
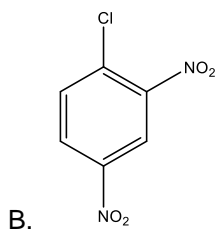
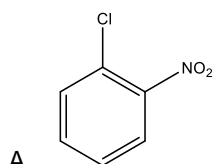
$[\text{Ni}(\text{CN})_4]^{2-}$ - d^8 - diamagnetic

$[\text{CuCl}_4]^{2-}$ - d^9 - paramagnetic

$[\text{Cu}(\text{CN})_4]^{3-}$ - d^{10} - diamagnetic

$[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ - d^9 - paramagnetic

13. Which of the following shows least reactivity towards nucleophilic substitution reaction?



Answer (C)

Solution:

Aryl halides containing EWG at ortho or para position are more reactive towards nucleophilic substitution reaction than meta isomer.

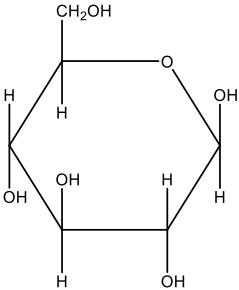
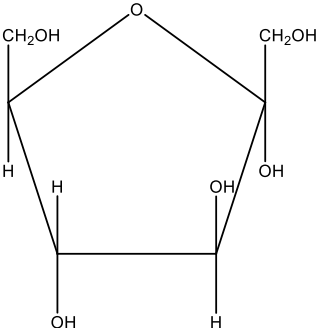
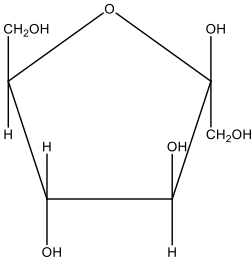
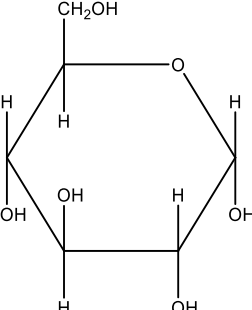
14. For a first order reaction, $A \rightarrow B$; $t_{1/2}$ is 30 minutes. Then find the time in minutes required for 75% completion of reaction?

Answer (60 minutes)

Solution:

$$t_{75\%} = t_{1/4} = 2 \times t_{1/2} = 2 \times 30 \text{ minutes} = 60 \text{ minutes}$$

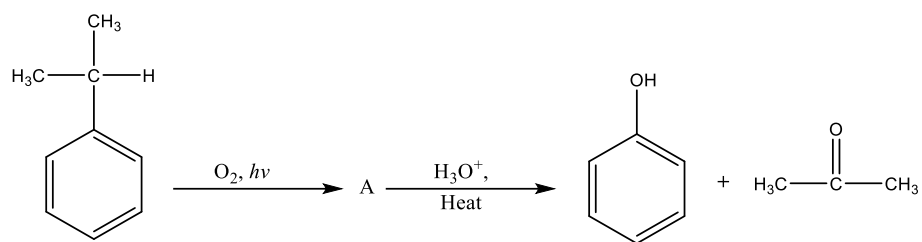
15. Match List – I with List – II.

List - I	List - II
<p>A. $\alpha - D - \text{Glucopyranose}$</p>	<p>1.</p> 
<p>B. $\beta - D - \text{Glucopyranose}$</p>	<p>2.</p> 
<p>C. $\alpha - D - \text{Fructofuranose}$</p>	<p>3.</p> 
<p>D. $\beta - D - \text{Fructofuranose}$</p>	<p>4.</p> 

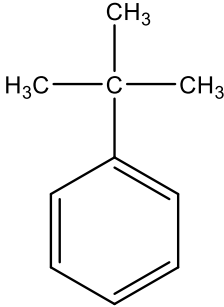
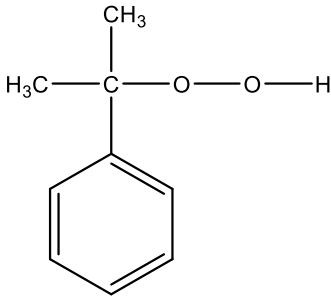
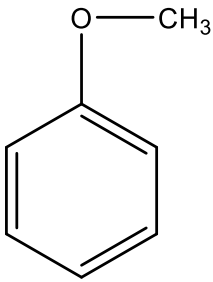
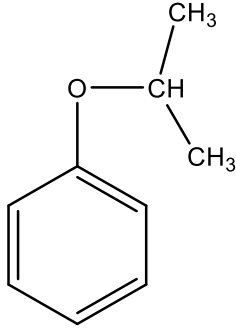
- A. A – 4 ; B – 1 ; C – 2 ; D – 3
- B. A – 1 ; B – 4 ; C – 3 ; D – 2
- C. A – 2 ; B – 3 ; C – 4 ; D – 1
- D. A – 1 ; B – 3 ; C – 2 ; D – 4

Answer (A)

16. Consider the following conversion.

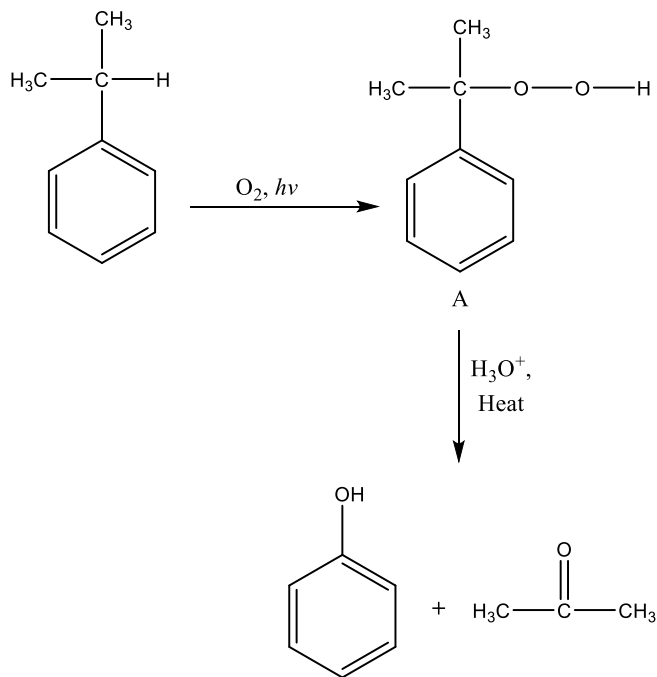


Which of the following option contains the correct structure of 'A'.

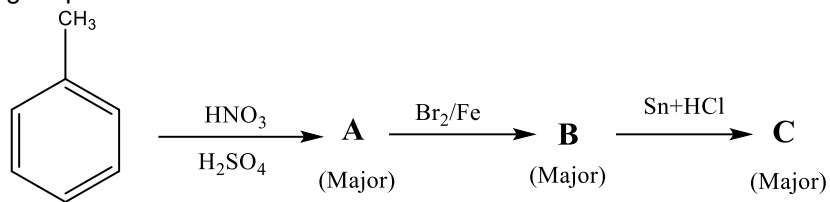
- A. 
- B. 
- C. 
- D. 

Answer (B)

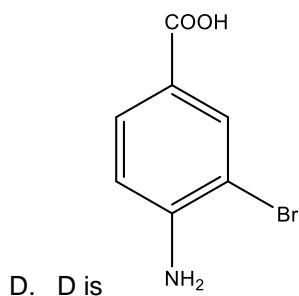
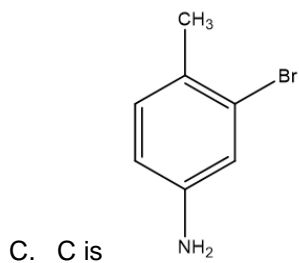
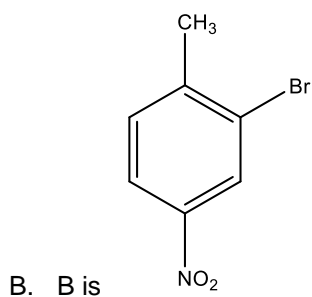
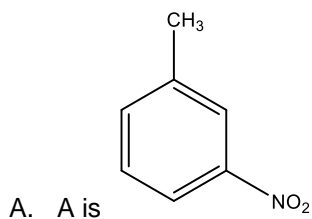
Solution:



17. Consider the following sequence of reaction.

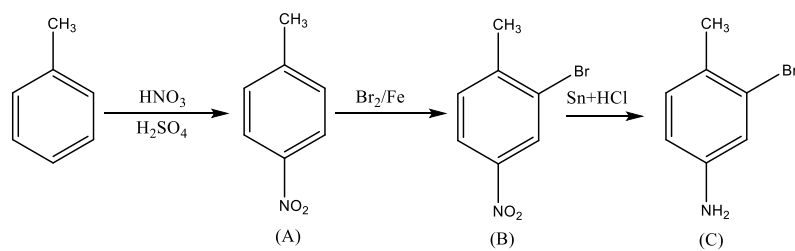


Which of the following option contains the correct structure?

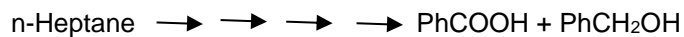


Answer (C)

Solution:



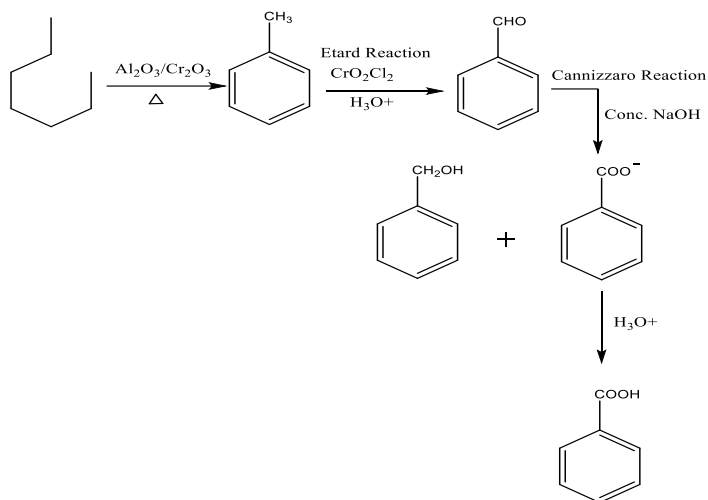
18. Identify the correct sequence of reactants for the following conversion.



- A. Al₂O₃/Cr₂O₃, CrO₂Cl₂/H₃O⁺, Conc. NaOH, H₃O⁺
- B. Al₂O₃/Cr₂O₃, CrO₂Cl₂/H₃O⁺, H₃O⁺, Conc. NaOH
- C. CrO₂Cl₂, Al₂O₃, Conc. NaOH, H₃O⁺
- D. Sn/HCl, Conc. NaOH, CrO₂Cl₂, HNO₃

Answer (A)

Solution:

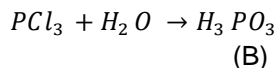
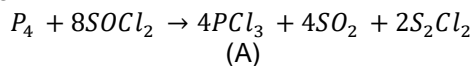


19. Thionyl chloride on reaction with white phosphorous gives compound A. A on hydrolysis gives compound B which is dibasic. Identify A and B.

- A. A - PCl₅, B = H₃PO₂
- B. A - P₄O₆, B = H₃PO₄
- C. A - POCl₃, B = H₃PO₄
- D. A - PCl₃, B = H₃PO₃

Answer (D)

Solution:



20. The correct decreasing order of positive electron gain enthalpy for the following inert gases.
He, Ne, Kr, Xe

- A. He > Ne > Kr > Xe
- B. He > Ne > Xe > Kr
- C. He > Xe > Ne > Kr
- D. Ne > Kr > Xe > He

