# SECTION – 3 : (Maximum Marks : 16)

- This section contains **TWO** questions
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A),(B), (C) and (D)
- **Column II** has **four** entries (P),(Q), (R) and (S)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**
- The ORS contains a 4 × 4 matrix whose layout will be similar to the one shown below :

(A)     [P] [Q] [R] [S]
(B)     [P] [Q] [R] [S]
(C)     [P] [Q] [R] [S]
(D)     [P] [Q] [R] [S]

- For each entry in **Column I**, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (P), (Q) and (R), then darken these three bubbles in the ORS. Similarly, for entries (B), (C) and (D).

- Marking scheme :

**For each entry in Column I**

+2  If only the bubble(s) corresponding to all the correct match(es) is (are) darkened
 0  If none of the bubbles is darkened
−1  In all other cases

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**Space for Rough Work**

In Column-I there are given some conditions in which a real gas & an ideal gas are taken. In Column-II, property of a real gas is given. Match the corresponding properties of real gas from Column-I to Column-II.

**Column-I**

(A) A sample of real gas is exerting a pressure 1 atm, similar amount (moles) of ideal gas taken in same container at same temperature exerts pressure 1.2 atm.

(B) A sample of real gas is occupying volume 22.4 L, same amount (moles) of ideal gas occupies volume 22 L under similar conditions of P & T.

(C) A sample of real gas contains 2 moles, A sample of an ideal gas contains 1.5 moles under similar conditions of P,V,T.

(D) A sample of real gas having temperature 273 K, similar amount (moles) of an ideal gas is having temperature 300 K at same P & V.

**Column-II**

(P)   $Z > 1$

(Q)   $Z < 1$

(R)   Gas is less compressible as compared to an ideal gas.

(S)   Gas is more compressible as compared to an ideal gas.

**Space for Rough Work**

22. Match the following

Column - I

(Compounds)

Column - II
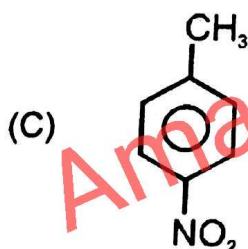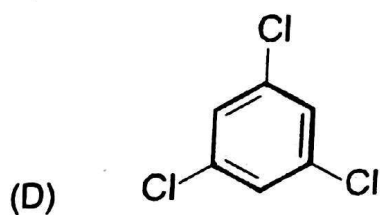
(Characteristics)

(A)



(P) Mesomeric effect / resonance

(B) Ph–CH=CH–CH$_3$
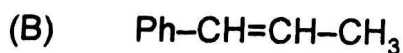
(Q) Inductive effect.

(C)



(R) Hyperconjugative effect

(D)



(S) Nonpolar

**Space for Rough Work**

## SECTION – 4 : (Maximum Marks : 72)

This section contains EIGHTEEN questions

The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 to 9, both inclusive

For each question, darken the bubble corresponding to the correct integer in the ORS

Marking scheme :

+4 If the bubble corresponding to the answer is darkened

 0 If none of the bubbles is darkened

–1 In all other cases

23. The outermost electronic configuration of a d-block element (M) is $ns^2np^6nd^x(n+1)s^2$. The magnetic moment of its trivalent chloride ($MCl_3$) is $2\sqrt{6}$ B.M. What is the value of '$x$'? [Assume $MCl_3$ as an ionic compound]

24. A mixture of 32 gm of $O_2$ gas and 16 gm $D_2$ gas is allowed to effuse through an orifice. If the relative rate of effusion $\left(\dfrac{r_{D_2}}{r_{O_2}}\right)$ at the start of effusion is expressed as $p \times \sqrt{2}$, then the value of p is :

25. If heat of reaction for the given acid-base reaciton :

$$HA + NaOH \rightarrow NaA + H_2O \; ; \; \Delta H = -6.7 \text{ kcal}$$

The heat of dissociation of HA (in Kcal/mol) is_____ .

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**Space for Rough Work**

26. 1 mole of an ideal gas goes from state A to state B as shown in figure.
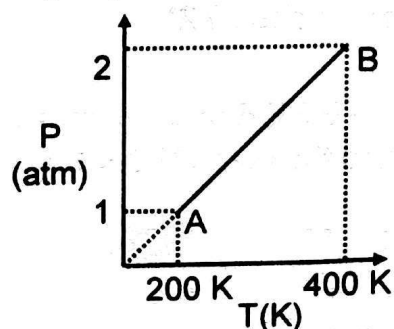


Calculate the work done by gas during the process.

27. 1 mole of an ideal gas is allowed to expand isothermally at 27°C till its volume is tripled . If the expansion is carried out reversibly then the $\Delta S_{universe}$ will be ?

28. Consider the following arrangement :



| $O_2$,(g) 300 K | $N_2$,(g) 300 K |
→ Adiabatic walls.
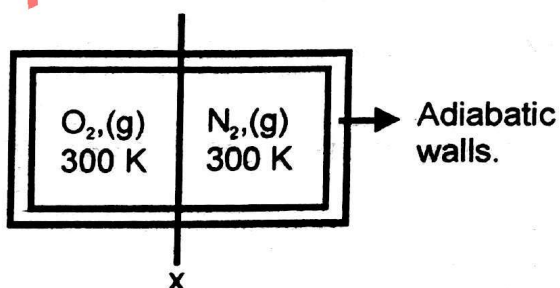
The gases are at same pressure.

If $O_2$ and $N_2$ are assumed to behave ideally, then on removing partition X (smoothly), how many of the following are expected to be incorrect for this process.

(i) $\Delta S_{sys} < 0$     (ii) $\Delta S_{surr} < 0$     (iii) $\Delta S_{univ} > 0$     (iv) $\Delta U > 0$

(v) $\Delta H > 0$     (vi) $\Delta G < 0$

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**Space for Rough Work**

29. $N_2O_3$ dissociates into NO and $NO_2$. At equilibrium pressure of 3 atm, all three gases were found to have equal number of moles in a vessel. In another vessel, equimolar mixture of $N_2O_3$, NO and $NO_2$ are taken at the same temperature but at an initial pressure of 9 atm then find the partial pressure of $NO_2$ (in atm) at equilibrium in second vessel.

30. How many of the following statement(s) is/are **Incorrect.?**
(1) Final temperature in adiabatic free expansion is less than final temperature in isothermal free expansion if carried out from same initial state involving an ideal gas.
(2) An adiabatic process is always an isoentropic process.
(3) More heat is absorbed by an ideal gas if subjected to isothermal reversible expansion process than an irreversible isothermal expansion process between same states.
(4) During isothermal expansion of any substance internal energy will remain constant.
(5) Adiabatic expansion always causes cooling.
(6) On isothermal expansion of an ideal gas upto same final volume from same initial state, final pressure will be more for irreversible process than reversible process.
(7) Work is always calculated by the expression $W = -P_{ext}(V_2-V_1)$

31. In how many of the following cases gas is more compressible than ideal gas ? $(R = \dfrac{1}{12}\dfrac{atm\,L}{mol\,K})$
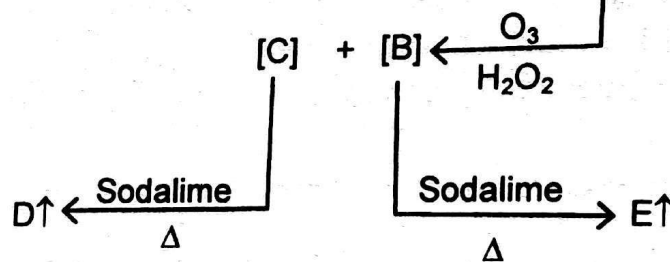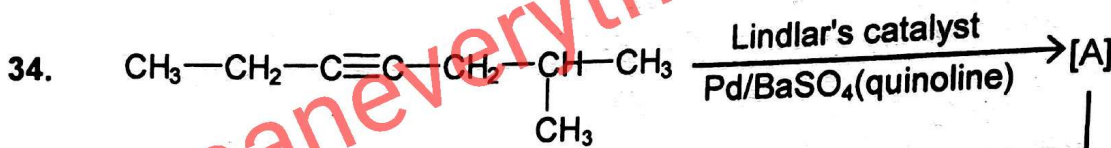
(i) $O_2$ gas has density = 20 g/L at 10 atm and 300 K temperature.
(ii) $N_2$ gas at 2 atm and 273 K occupy molar volume 6 L.
(iii) Gas A at its critical temperature & pressure less than critical pressure.
(iv) $H_2$ gas at NTP
(v) Gases having their temperature above their Boyle's temperature.

(vi) Gases having their temperature below their Boyle' temperature in low pressure range.

(vii) $CH_4$ gas at 333 K & in low pressure region. (Boyle's temperature $T_B$ of $CH_4$ = 60°C)

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**Space for Rough Work**

**32.** How many species out of the following are aromatic?

(i)   (ii)   (iii)   (iv)

(v)   (vi)   (vii)   (viii)

(ix)
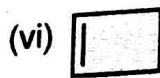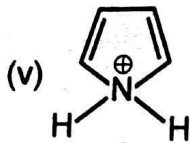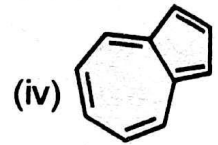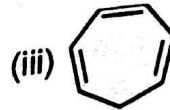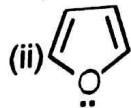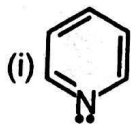
**33.** Solid $CuSO_4.5H_2O$ having covalent, ionic as well as co-ordinate bonds, copper atom/ion fo
................Co-ordinate bonds with water.

**34.** $CH_3-CH_2-C\equiv C-CH_2-CH-CH_3$ $\xrightarrow[\text{Pd/BaSO}_4\text{(quinoline)}]{\text{Lindlar's catalyst}}$ [A]
with $CH_3$ branch

[A] $\xrightarrow[H_2O_2]{O_3}$ [C] + [B]

[C] $\xrightarrow[\Delta]{\text{Sodalime}}$ D↑
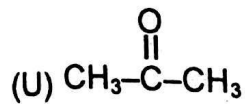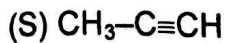
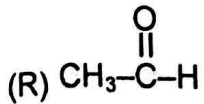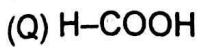[B] $\xrightarrow[\Delta]{\text{Sodalime}}$ E↑

Compound (D) contains less number of carbon atoms than compound (E). How many monobromo
derivatives are possible for compound (E) ?
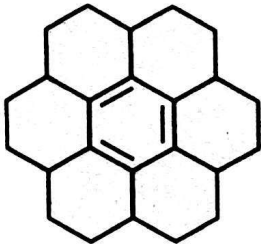
**Space for Rough Work**

35. $K_2CO_3$, $Rb_2CO_3$, $CaCO_3$, $BeCO_3$, $Na_2CO_3$, $BaCO_3$, $SrCO_3$ Among the above mentioned carbonates the no of carbonates which are more thermally stable than $MgCO_3$ is _____

36. How many of the following compounds give positive Tollen's test?

(P) $CH{\equiv}CH$

(Q) $H{-}COOH$

(R) $CH_3{-}\overset{\overset{O}{\|}}{C}{-}H$

(S) $CH_3{-}C{\equiv}CH$

(T) $CH_3{-}NC$

(U) $CH_3{-}\overset{\overset{O}{\|}}{C}{-}CH_3$

(V) 
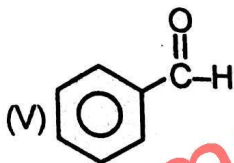
37. Total number of hyperconjugative hydrogen atom in the given compound is:



**Space for Rough Work**

**38.** How many of the following statements are correct ?

(a) BeO is amphoteric in nature.

(b) $LiHCO_3$ is not found in solid state.

(c) $K_2O_2$ is diamagnetic but $KO_2$ is paramagnetic.

(d) White phosphorous react with castic soda and gives phosphine gas.

(e) $Na_2CO_3$ is converted to $Na_2O$ & $CO_2$ on heating.

(f) Sodium nitrate on heating at 500ºC gives sodium oxide and nitrogen gas.

(g) $CaCl_2$ is obtained as by product in Solvay process.

(h) Hydrated magnesium chloride on heating in dry air gives anhydrous $MgCl_2$.

**39.** How many of the following are correctly matched?

(1) $LiH > NaH > KH > CsH$          Reducing power

(2) $MgCO_3 < K_2CO_3 < CsCO_3$          Thermal stability

(3) $LiF < NaF < KF < CsF$          Solubility

(4) $Be^{+2} > Ca^{2+} > Sr^{+2} > Ba^{+2}$          Extent of hydration

(5) $CsO_2 > RbO_2 > KO_2 > NaO_2$          Thermal stability

(6) $LiOH < NaOH < KOH < CsOH$          Basic character

(7) $Li < Na < K < Rb$          Metallic bond strength

(8) $BeI_2 > CaI_2 > SrI_2 > BaI_2$          Covalent character

(9) $Cs < Be < Ca < K$          Ionisation enthalpy

**40.**



$$\xrightarrow{SOCl_2} \text{Product}$$

Number of carbon atom present in product is :

**Space for Rough Work**