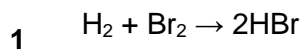


1	D	2	C	3	A	4	C	5	C
6	B	7	C	8	D	9	C	10	D
11	C	12	B	13	C	14	B	15	A
16	A	17	C	18	B	19	B	20	A
21	B	22	C	23	C	24	C	25	D
26	B	27	B	28	B	29	B	30	A



Amt of $\text{H}_2 = 3/2 \text{ mol}$

Amt of $\text{Br}_2 = 160/159.8 = 1 \text{ mol}$ (limiting agent)

Hence, amt of HBr formed = 2 mol

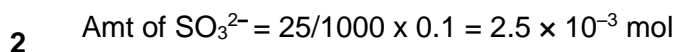
No of molecules present at the end of reaction

$$= (2+1/2) \times 6.0 \times 10^{23}$$

$$= 1.5 \times 10^{22}$$

$$= 15.1 \times 10^{23}$$

Ans: **D**



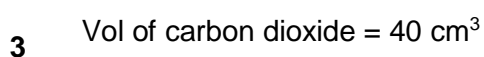
$$\text{Amt of } e^- = 2 \times 2.5 \times 10^{-3} = 5.0 \times 10^{-3} \text{ mol}$$

$$\text{Amt of metallic salt} = 50/1000 \times 0.1 = 5.0 \times 10^{-3} \text{ mol}$$

Hence mole ratio of metallic salt : e^- is 1:1

Since original oxidation number of the metal in the salt is +3, after gaining 1 e^- , the new oxidation number will be +2.

Ans: **C**



Vol of organic compound = 20 cm^3

$$\text{Hence, no. of C} = \frac{40}{20} = 2$$

$$\text{Vol of nitrogen (N}_2\text{)} = 20 \text{ cm}^3$$

$$\text{Hence, no. of N} = \frac{20}{20} \times 2 = 2$$

Only option A of $\text{C}_2\text{H}_8\text{N}_2$ fits the answer

Ans: **A**

- 4 The dominant intermolecular forces of attraction between iodine is temporary dipole induced dipole interactions, while that between water is hydrogen bonding. Since iodine exists as solid while water exists as liquid at rtp, it implies that the temporary dipole induced dipole interactions between iodine are stronger than the H-bonds between water, requiring more energy to break, and energy at r.t.p is insufficient to break them, hence they exist as solid.

Ans: **C**

- 5 The definition for bond energy is the Energy absorbed to break one mole of covalent bonds between atoms in a diatomic gaseous molecule or a particular type of bond in a gaseous polyatomic molecule to give gaseous atoms.

Only in option C was the gaseous molecule broken up into its constituent gaseous atoms.

Ans: **C**

- 6 For **A**, the energy gap is relatively larger between the removal of the 2nd and 3rd electron => Group II

For **B**, the energy gap is relatively larger between the removal of the 7th and 8th electron => Group VII

Hence, the formula when **A** and **B** reacts is **AB₂**.

Ans: **B**

- 7 α -particle (which is a He nucleus) contains 2 protons and 2 neutrons.

When $^{222}_{86}\text{Rn}$ emits an α -particle, 2 protons and 2 neutrons are lost

Proton number = $86 - 2 = 84$

Nucleon number = $222 - 4 = 218$

As the He nucleus is heavier and oppositely charged than an electron, it will move in the opposite direction and have a smaller angle of deflection.

Ans: **C**

- 8 $t_{1/2} = \frac{\ln 2}{k} = \frac{\ln 2}{0.26} = 2.66 \text{ h}$

When 75% of the paracetamol consumed is removed, it means 25% ($= \frac{1}{4}$) of the paracetamol consumed remains and 2 $t_{1/2}$ must have lapsed.

$\therefore t = 2t_{1/2} = 5.3 \text{ h}$

Ans: **D**

- 9 Equilibrium constant, K_c , is temperature dependent, i.e. it changes only if temperature changes.

Option **A** is **not** true as the total pressure of the reaction mixture remains constant since the total number of gaseous particles remained unchanged.

Option **B** is **not** true as the position of the equilibrium has time to change due to slow cooling of reaction mixture. The eqm constant determined is likely one at well below 300 °C.

Option **C** is true as the position of the equilibrium has no or little time to change due to rapid cooling of reaction mixture. The eqm constant determined is likely to be one at 300 °C.

Option **D** is **not** true as the method gives only the initial amount of iodine used.

Ans: **C**

- 10 Option **A** is **not** true as dissociation of water involves breaking of O–H bonds and must be endothermic.

Option **B** is **not** true as dissociation of water always results in the same amount of $H^+(aq)$ and $OH^-(aq)$ formed; $pH = pOH$

Option **C** is **not** true as $[H^+(aq)] = [OH^-(aq)]$ is always true, i.e. water is neutral, at all temperatures.

Option **D** is true as values of $K_a = \frac{K_w}{55.5} = 1.8 \times 10^{-16}$, $K_w = 10^{-14}$ and $[H^+] = 10^{-7}$

Ans: **D**

- 11 Since total vol of reaction was kept constant in all 4 expts, concentration of each reactant \propto its volume used

Rate is $\propto \frac{dV}{dt}$, where V is the volume of **D**

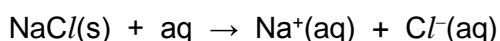
Comparing data from expt 1 & 2, when vol of **E** is halved (while keeping vol of **D** and **Y** constant), rate is also halved \Rightarrow order of reaction wrt **E** is 1

Comparing data from expt 1 & 3, when vol of **Y** is halved (while keeping vol of **D** and **E** constant), rate is also halved \Rightarrow order of reaction wrt **Y** is 1

Comparing data from expt 1 & 4, when vol of **D** is halved (while keeping vol of **E** and **Y** constant), rate remains unchanged \Rightarrow order of reaction wrt **D** is 0

Ans: **C**

- 12 NaCl dissolves in water to form a neutral solution of $\text{pH} = 7$.

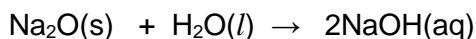


Na^+ does not hydrolyse in water because of low charge density. Cl^- is a weak conjugate base of the strong acid HCl ; hence does not hydrolyse in water.

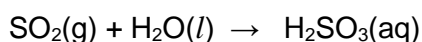
SiCl_4 hydrolyses in water to give an acidic solution of $\text{pH} = 2$



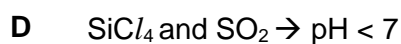
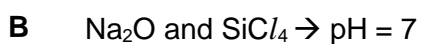
Na_2O dissolves in water to form a strongly alkaline solution of NaOH ($\text{pH} = 13$ or 14).



SO_2 dissolves in water to form an acidic solution of $\text{H}_2\text{SO}_3(\text{aq})$



Hence mixing of

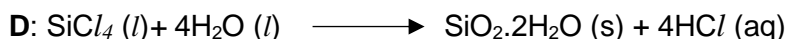
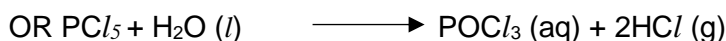
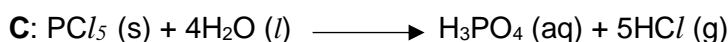
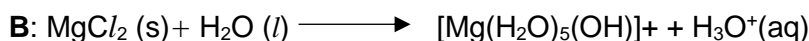
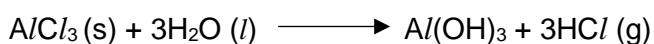


Ans: **B**

- 13 "Due to the lack of dipole moments in alkane molecules, there is a lack of electron-rich and electron deficient centres to attract nucleophiles and electrophiles for reaction.

Ans: **C**

- 14 **A:** Al_2Cl_6 also refers to AlCl_3



Ans: **B**

- 15 Acidic oxide: SiO_2 and P_4O_{10}

Basic: NaO

Amphoteric: Al_2O_3

Ans: **A**

- 16 Inter-electronic repulsion between the lone pairs on F atoms in a F_2 molecule causes the F–F bond to be longer and weaker than expected.

Ans: **A**

- 17 The weak van der Waals' attraction between layers allow the layers of carbon to slide over one another and act as a lubricant.

Ans: **C**

- 18 **A:** A catalyst only increases the rate of the reaction, but the equilibrium constant does not change. Hence, the ratio of concentration of products to reactants remains the same.

B: True

C: Rate constant **increases** with a catalyst as the rate reaction increases.

D: The rate of collision remains the same as the energies of the particles do not change. Only the rate of effective collision increases as there are more particles with energy greater than the lowered activation energy.

Ans: **B**

- 19 **Endothermic:** Ionisation Energy

Either exothermic or endothermic: Formation or bond energy

Always exothermic: Lattice Energy

Ans: **B**

- 20 Step 1: oxidation of primary alcohol to aldehyde

Step 2: nucleophilic addition of aldehyde

Step 3: oxidation (loss of hydrogen)

Ans: **A**

- 21 Methyl group is 2,4 directing. Hence, the 3-bromomethylbenzene is least likely to form from methylbenzene.

Ans: **B**

22	Clues	Deductions
	reacts with sodium to give hydrogen	Contains $COOH$ or OH
	does not react with 2,4-dinitrophenylhydrazine	Does not contain $C=O$
	does not react with ethanol in the presence of concentrated sulfuric acid to give an ester.	Does not contain $COOH$ or OH

Ans: **C**

- 23 2, 4-dinitrophenylhydrazine reacts with carbonyl compounds via condensation, forming a new $C=N$ bond. Phenylhydrazine reacts in similar way with the ketone in compound **O**. The ester functional group does not react with phenylhydrazine.

Ans: **C**

24		Reacts with
	HCl(aq)	CH ₃ CO ₂ (CH ₂) ₄ CH ₃
	HCN(aq) with a little KCN	CH ₃ COCH ₃
	Na	NIL
	NaBH ₄	CH ₃ COCH ₃

Ans: **C**

25		Functional groups it reacts with
	Aqueous bromine	C=C
	2, 4-dinitrophenylhydrazine	C=O
	Fehling's reagent	Aliphatic aldehyde
	Na ₂ CO ₃	Carboxylic acid

Ans: **D**

26	1	N ⁻	1s ² 2s ² 2p ⁴	2 unpaired e ⁻
		C ⁺	1s ² 2s ² 2p ¹	1 unpaired e ⁻
	2	Mn ²⁺	[Ar] 3d ⁵	5 unpaired e ⁻
		Co ²⁺	[Ar] 3d ⁷	3 unpaired e ⁻
	3	Mn ⁴⁺	[Ar] 3d ³	3 unpaired e ⁻
		Co	[Ar] 3d ⁷ 4s ²	3 unpaired e ⁻

Ans: **B**

- 27 Option 1 is true as RCO₂H has a smaller K_a means it is a weaker acid and dissociates in aq solution to give a lower [H⁺(aq)] and thus has a higher pH.

Option 2 is true as K_a × K_b = K_w = 10⁻¹⁴ mol² dm⁻⁶. An acid with a larger K_a would give a conjugate base with a lower K_b value and vice versa.

Option 3 is **not** true as R₁CO₂H has a larger K_a means it is the stronger acid.

Ans: **B**

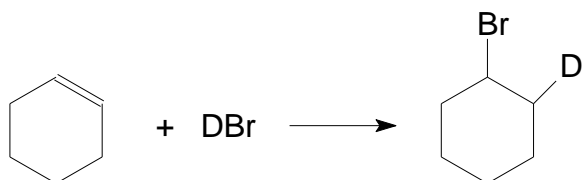
- 28 Option 1 is true as each NH₃ donates H⁺ (act as Bronsted acid) to form NH₂⁻.

Option 2 is true as Na is oxidised to Na⁺ in NaNH₂.

Option 3 is **not** true as NH₃ acts a nucleophile in the reaction.

Ans: **B**

29



1

2 $\text{CHBr=CHBr} + \text{DBr} \rightarrow \text{CHBr}_2\text{CHDBr}$

3 cannot be formed in a single step

Ans: B

30

1	<p>Reaction scheme showing 1,4-dimethylcyclohexa-1,4-diene reacting to form $2\text{CH}_3\text{COCH}_2\text{CO}_2\text{H}$.</p>
2	<p>Reaction scheme showing 1-methylbicyclo[2.2.1]hept-2-ene reacting to form 2-methylcyclohexane-1,4-dione.</p>
3	$\text{CH}_3\text{--CH}_2\text{--CH}_2\text{--CH=CH}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + \text{CO}_2 + \text{H}_2\text{O}$

Ans: A