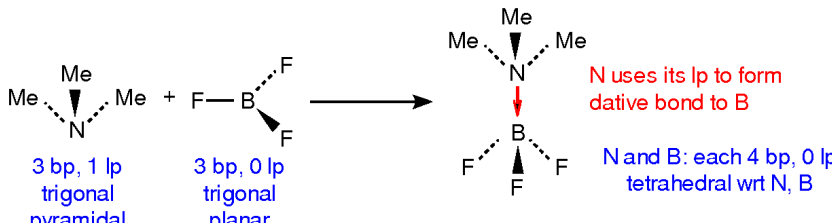
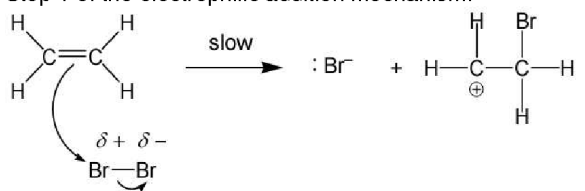


- 1 **D**  
 $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$   
 But 1  $\text{S}_2\text{O}_3^{2-} \equiv 4 \text{Cl}_2 \equiv (4 \times 2) \text{e}^-$   
 i.e. 1 mol  $\text{S}_2\text{O}_3^{2-}$  transfers 8 mol  $\text{e}^-$  to 4 mol  $\text{Cl}_2$ .
- 2 **C**  
 Observe the pattern in the equation  
 $\text{Zn}(\text{C}_2\text{H}_5)_2 + 2\text{HX} \rightarrow \text{ZnX}_2 + 2\text{C}_2\text{H}_5\text{H}$  ( $2\text{C}_2\text{H}_6$ )  
 (The formula  $\text{C}_2\text{H}_6$  has been rewritten to show where the H came from.)  
 Applying to the reaction of  $\text{Zn}(\text{C}_2\text{H}_5)_2$  with  $\text{H}_2\text{O}$ , we see that  $\text{H}_2\text{O}$  is just **HOH** i.e. **X = OH**.  
 Hence  $\text{Zn}(\text{C}_2\text{H}_5)_2 + 2\text{HOH} \rightarrow \text{Zn}(\text{OH})_2 + 2\text{C}_2\text{H}_5\text{H}$  ( $2\text{C}_2\text{H}_6$ )
- 3 **C**
- 
- 4 **D**  
 Gases most ideal at high  $T$  and low  $p$ . High pressure  $\Rightarrow$  not ideal.
- 5 **D**  
 Highest energy  $\text{e}^-$  is lost first.
- 6 **B**  
 $r_+(\text{Rb}^+) < r_+(\text{Cs}^+)$  and  $r_-(\text{F}^-) < r_-(\text{Cl}^-)$   
 So interionic distance ( $r_+ + r_-$ ) increases in the order:  
 (smallest)  $\text{RbF} < \text{CsF} < \text{CsCl}$  (largest)  
 Since  $|\text{LE}| \propto \frac{|z_+ z_-|}{r_+ + r_-}$ , LE of  $\text{CsF}$  is also intermediate between those of  $\text{RbF}$  and  $\text{CsCl}$ .
- 7 **D**
- 8 **C**  
 $T$  increase,  $K_p$  increase  $\Rightarrow$  poe shifted right  $\Rightarrow$  forward reaction is endothermic.

- 9 **C**  
 Number of molecules with energy  $\geq E_a$  at  $T_2 = Q + R$ .  
 Total number of molecules is the same at  $T_1$  and  $T_2$  and is equal to  $P + Q$ .
- 10 **C**
- G:**  $4x \xrightarrow{5 \text{ min}} 2x \xrightarrow{5 \text{ min}} x \xrightarrow{5 \text{ min}} \frac{1}{2}x$
- H:**  $x \xrightarrow{15 \text{ min}} \frac{1}{2}x$
- 11 **A**  
 $Y$  forms 5 bonds, so it can expand its octet, i.e. it is in Period 3 and below. It can be a Group V element such as P.  
 $X$  forms 3 bonds; Group III or V.  
 $Z$  forms 1 bond; Group I or VII.
- 12 **B**  
 With  $\text{HCl}$ , colourless gas formed  $\Rightarrow$  can be  $\text{CO}_2 \Rightarrow \text{CO}_3^{2-}$  present.  
 $\text{BaSO}_4$  does not react and is insoluble in water.  
 Not **A**.  $\text{NO}_3^-$  and  $\text{OH}^- + \text{H}^+ \rightarrow$  no gas evolved.  
 Not **C** and **D**.  $\text{CO}_2$  evolved. Both dissolve.  
 Note: Action of dilute acid: (1)  $\text{CO}_3^{2-} \rightarrow \text{CO}_2$ ; (2)  $\text{SO}_3^{2-} \rightarrow \text{SO}_2$ ; (3)  $\text{NO}_2^- \rightarrow \text{NO}_2$ .  
 Sulfates and nitrates  $\rightarrow$  no reaction.
- 13 **A**
- (i)  $|\text{LE}| \propto \frac{|z_+ z_-|}{r_+ + r_-}$
- (ii)  $|\Delta H_{\text{hyd}}| \propto \frac{|z_+|}{r_+}$
- (iii)  $\text{MgSO}_4$  is soluble;  $\text{BaSO}_4$  is insoluble.
- 14 **C**  
 $\text{NH}_3 \rightarrow \text{NH}_2^-$  ( $\text{H}^+$  removed; N now has two lone pairs).
- 15 **B**  
 Strength of dispersion forces increase down the Group as number of electrons per molecule increases and molecule becomes more polarisable.
- 16 **D**  
 cold aq  $\text{NaOH}$ :  $\text{Cl}_2 + 2\text{OH}^- \rightarrow \text{Cl}^- + \text{ClO}^- + \text{H}_2\text{O}$  ( $0 \rightarrow -1, +1$ )  
 hot aq  $\text{NaOH}$ :  $3\text{Cl}_2 + 6\text{OH}^- \rightarrow 5\text{Cl}^- + \text{ClO}_3^- + 3\text{H}_2\text{O}$  ( $0 \rightarrow -1, +5$ )

- 17 **D**  
From the formula  $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ , the metal ion is  $\text{Cr}^{3+}$ .  
Only free  $\text{Cl}^-$  (i.e. not datively bonded to the central metal atom/ion) can be precipitated by  $\text{Ag}^+$ . Hence there is one free  $\text{Cl}^-$  in the compound and the other two  $\text{Cl}^-$  are ligands bonded to  $\text{Cr}^{3+}$ . Assuming a coordination number of 6 for Cr in the complex, there are four  $\text{H}_2\text{O}$  ligands and two  $\text{Cl}^-$  ligands, Hence the formula of the complex is  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$ .
- 18 **C**  
A ligand must possess at least a lone pair of electrons.  $\text{NH}_4^+$  does not have any lone pair.
- 19 **D**  
Not possible to have *cis-trans* isomers because of  $=\text{CH}_2$ . No chiral centre.
- 20 **A**  
Step 1 of the electrophilic addition mechanism:  


The carbocation formed can now react with  $:\text{ONO}_2^-$  (nitrate ion). The lone pair of electrons on O forms a bond to the  $\text{C}^+$  to form the product.

21 **D**  
NS. Rate of reaction depends on C-X bond strength.

22 **C**  
**A** and **D** are acyl chlorides; react without heating with  $\text{Ag}^+$  to form  $\text{AgCl}$ .  
**B** is an aryl chloride; resistant to hydrolysis with aq  $\text{NaOH}$ .  
**C** is an  $\text{RX}$ ; hydrolysed to form  $\text{ROH}$  and  $\text{Cl}^-$  when refluxed with aq  $\text{NaOH}$ .

23 **B**  
 $(\text{CH}_3)_2\text{CHBr} \rightarrow (\text{CH}_3)_2\text{CHCN}$   
Not **A** and **C**. The starting halogen compound  $\text{CH}_2=\text{CHBr}$  and  $\text{C}_6\text{H}_5\text{Br}$  contain very strong C-Br bonds (overlap of lone pair of  $e^-$  on Br with  $\pi$  bond /  $\pi$  ring).

24 **B**  
Highest pH  $\Rightarrow$  most basic.  $\text{C}_2\text{H}_5\text{NH}_2$  is a stronger base than **D**, an aromatic amine.

- 25 **B**  
Triiodomethane test. This gives yellow precipitate showing the presence of propanone (a methyl ketone).  
Propanone does not react with reagent **A**. (What is this reagent?)  
Propanone also does not react with **C** ( $\text{H}^+/\text{Cr}_2\text{O}_7^{2-}$ ) and **D** ( $\text{Na}$ ) but the alcohol does react with both. But the question wants to test for the *presence of propanone*, not the alcohol.
- 26 **D**  
Carboxylic acid  $\rightarrow$  acyl chloride
- 27 **B**  
Acid hydrolysis of nitrile ( $\text{C}\equiv\text{N}$ ) to form carboxylic acid.
- 28 **A**  
Dopamine contains amine, phenol and carboxylic acid functional groups. Only phenol and carboxylic acid groups react to form the salts.
- 29 **A**  
Reaction I is of the type  $\text{A} + \text{B} \rightarrow$  one product only  $\Rightarrow$  addition.  
Reaction II is of the type  $\text{X} \rightarrow \text{Y} +$  small molecule  $\Rightarrow$  elimination.
- 30 **C**  
GABA is not an  $\alpha$ -amino acid (2-aminocarboxylic acid). The  $\text{NH}_2$  and  $\text{CO}_2\text{H}$  groups are not attached to the same C.
- 31 **D**  
Option 1 17n in P > 16n in S.  
Option 2 Adding a neutron produces  $^{33}_{15}\text{P}$ .  
Option 3 15e in P vs 16e in S.
- 32 **C**  
Option 1 Hydration  $\Rightarrow$  bonds formed  $\Rightarrow$  exothermic.  
Option 2 Bond breaking  $\Rightarrow$  endothermic.  
Option 3 Solid  $\rightarrow$  gas  $\Rightarrow$  break intermolecular bonds  $\Rightarrow$  endothermic.
- 33 **D**  
Option 1  $\text{C}_2\text{H}_5\text{OH}$  consists of polar molecules.  
Option 2  $\text{NaCl}$  consists of ions.  
Option 3  $\text{SiO}_2$  has a giant covalent structure, does not contain discrete (simple) molecules.

- 34 **C**  
The formula of sodamide can be re-written to show its constituent ions.  
$$2 \text{Na} + 2 \text{NH}_3 \rightarrow 2 \text{Na}^+ \text{NH}_2^- + \text{H}_2$$
  
Na: 0 to +1 (oxidised)  
N: -3 to -3 (no change)  
H: +1 to 0 (reduced)
- 35 **C**  
Option 1 Totally so wrong!  
Option 2 High charge density  
Option 3  $\text{Al}^{3+}$  polarises the coordinated water molecules, weakening the O-H bond.
- 36 **A**  
Option 1 4 bond pairs, 0 lone pair.  
Option 2 Simple molecular structure, just like  $\text{SiCl}_4$ .  
Option 3 Similar to  $\text{SiCl}_4$ .
- 37 **B**  
Option 1 Closer interatomic distances => closer packing => stronger bonds => higher mp.  
Option 2 More valence electrons used in delocalised sea of electrons => stronger metallic bonds.
- 38 **B**  
Jasmone contains a ketone group and an alkene group.  
Option 1 Alkene reacts; purple  $\text{MnO}_4^-$  decolorised.  
Option 2 Alkene reacts; reddish-brown  $\text{Br}_2$  decolorised  
Option 3 No reaction.
- 39 **C**  
Option 1 No reaction  
Option 2  $\text{CO} + \text{NO}_x \rightarrow \text{CO}_2 + \text{N}_2$   
Option 3 Correct.
- 40 **B**  
Option 1 1° alcohol.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \rightarrow$  aldehyde  $\rightarrow$  carboxylic acid. Some aldehyde that escapes the oxidation enters second test-tube and gives orange precipitate with 2,4-DNPH.  
Option 2 2° alcohol.  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3 \rightarrow$  ketone. Ketone gives orange precipitate with 2,4-DNPH in second test-tube.  
Option 3 3° alcohol. Resistant to oxidation.