2018 SH1 H1 Promotional Exam Answer
Paper 1

1	**B**	**6**	**D**	**11**	**C**	**16**	**D**
2	**A**	**7**	**A**	**12**	**A**	**17**	**B**
3	**B**	**8**	**A**	**13**	**C**	**18**	**D**
4	**C**	**9**	**B**	**14**	**C**	**19**	**C**
5	**A**	**10**	**D**	**15**	**B**	**20**	**C**

1 Ans: B

Relative atomic mass of Zn = $\frac{100}{210} \times 64 + \frac{80}{210} \times 65 + \frac{20}{210} \times 67 + \frac{10}{210} \times 68 = 64.86 \approx 64.9$ (1dp)

2 Ans: A

Isotope	No. of protons	No. of neutrons
^{10}B	5	5
^{32}S	16	16
^{32}P	31	17
^{40}K	19	21
^{40}Ar	18	22

3 Ans: B

Let the molecular formula of the hydrocarbon be C_xH_y.

	$C_xH_y + (x + \frac{y}{4})\ O_2 \rightarrow$		$x\ CO_2$ +	$\frac{y}{2}\ H_2O$
Initial	15	75	-	-
Change	–15	–45	+30	
End	0	30	30	
Amt reacted	1	3	2	

$x = 2$ and $x + \frac{y}{4} = 3 \Rightarrow y = 4$ $\therefore$ molecular formula = C_2H_4

4 Ans: C

$MnO_4^- + 5e + 8H^+ \rightarrow Mn^{2+} + 4H_2O$

Amt of electrons released during [O] = Amt of electrons gained during [R]
= (0.006) × 5
= 0.030 mol

Amount of Z_2O_x = 0.005 mol

Amt of electrons lost per mole of Z_2O_x = 0.030/0.005 = 6 mol
Amt of electrons lost per mole of Z = 3 mol
During oxidation, oxidation state of Z **<u>increases by 3 units</u>** from **<u>+3</u>** (in Z_2O_x) to **<u>+6</u>** (in product)
Hence **x = 3**

5 Ans: A

Angle of deflection $\propto \frac{charge}{mass}$
Protons would be attracted to negatively charged plate while electron would be attracted to positively charged plate.

Since charge of protons and electrons are the same but mass of electrons is much smaller, electron would be deflected more.

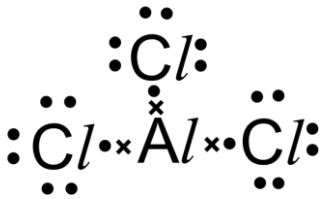
6 **Ans: D**
Second ionisation is the removal of an electron from 1 mole gaseous singly charged cation to form 1 mole of gaseous doubly charged cation.

7 **Ans: A**
A dative bond is formed when N atom in NH_2CN donates the lone pair of electrons to the empty 2p orbital of B atom in BF_3. Since there are four bond pairs, the geometry about B and N central atoms is tetrahedral.
The C atom in NH_2CN does not have any lone pair of electrons.
The two covalent molecules do not form ions when reacted.

8 **Ans: A**

Bond angle	Electrons regions	Shape	Bond angle
x	3b.p. 0 l.p.	Trigonal planar	120°
y	3b.p. 1 l.p.	Trigonal pyramidal	107°
z	4b.p. 0 l.p.	Tetrahedral	109.5°

9 **Ans: A**



After bonding, there are 6 electrons around Al (3b.p. 0l.p.). The shape is trigonal planar and it is a non-polar molecule with intermolecular forces of temporary dipole – induced dipole interaction.

10 **Ans: D**
Both Si and O are non-metal that form a giant covalent lattice for SiO_2 which has structure similar to that of diamond.

11 **Ans: C**
Enthalpy change of formation is the formation of 1 mol of product from its constituent elements in their standard state (C(s) and $O_2(g)$).
Enthalpy change of combustion is the complete combustion of 1 mol of reactant to give oxidized product (e.g. $CO_2(g)$)

12 **Ans: A**
By Hess's Law,
$\Delta H_1 = 601 + 58 + ½ (-1700) = -191$ kJ mol^{-1}

13 **Ans: C**
Formation of ionic bonds from gaseous Al^{3+} and O^{2-} is an exothermic process.
Breaking of Br–Br covalent bond is an endothermic process.
First I.E. of Na is an endothermic process.

14 **Ans: C**
From the graph, at low [HC*l*], as [HC*l*] increases, rate increases proportionally. Hence it is first order w.r.t. HC*l* at low [HC*l*].
At high [HC*l*], as [HC*l*] increases, rate remains constant. Hence it is zero order w.r.t. HC*l* at high [HC*l*].
[sodium thiosulfate] is kept constant throughout all reactions, hence we are unable to determine the effect of [sodium thiosulfate] on rate of reaction.

15 **Ans: B**

Since we are monitoring time taken for a fixed amount of I_2 to be formed, rate $\propto \frac{1}{time\ taken}$

Comparing expt 1 & 2, [KI] remain constant and $[(NH_4)_2S_2O_8]$ × 2, rate also × 2. Hence it is first order w.r.t $(NH_4)_2S_2O_8$.

Comparing expt 1 & 3, $[(NH_4)_2S_2O_8]$ remain constant and [KI] × 3, rate also × 3. Hence it is first order w.r.t KI.

Rate = $k[(NH_4)_2S_2O_8][KI]$

Using expt 1 data, 1/35 = k (0.1)(0.2), k = 1.429

Using the value of k for expt 4 (since same temperature condition), 1/(time taken) = 1.429(0.02)(0.750),

Time taken = 46.7s

16 **Ans: D**

Catalyst increases the rate of reaction by lowering the activation energy. Rate constant increases.

ΔH is not affected by the presence of a catalyst.

17 **Ans: B**

Reactants: 100% → 50% → 25% → 12.5%

To achieve 20% of the initial amount, time taken is between 2-3 half-lifes.

$(\frac{1}{2})^n = \frac{\text{final concentration}}{\text{initial concentration}}$, where n is the number of half-life

$(\frac{1}{2})^n = \frac{20}{100}$

n = 2.32

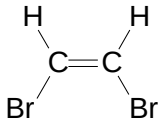
The time required = 2.32 × 5500 = 12760 years

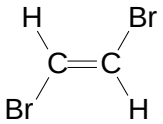
18 **Ans: D**

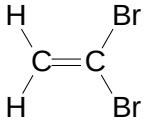
The compounds are chain-branch isomers.

Straight chain isomer has greater surface area for intermolecular interactions of temporary dipole-induced dipole. Hence higher boiling point as compared to the branched isomers.

19 **Ans: C**







20 **Ans: C**

For C=C, there are 1σ+ 1π bond

For C≡N, there are 1σ+ 2π bonds

Total 8σ + 6π bonds

There are 2 lone pairs electrons (1 for each N atom)

The shapes around the C atoms are linear and trigonal planar. Thus the molecule is planar.