

Scholar Advanced Higher Chemistry - Revision

Please attempt the following questions in preparation for the online tutorial on Tuesday 15th May.

1. Ultraviolet and infrared radiation can both be used in analytical techniques. Compared to infrared radiation, ultraviolet radiation has a
 - A shorter wavelength and higher velocity
 - B shorter wavelength and higher frequency
 - C longer wavelength and lower velocity
 - D longer wavelength and lower frequency.

2. An ion, X^{3+} , contains 55 electrons. In which block of the periodic table would element X be found?
 - A s
 - B p
 - C d
 - D f

3. Which of these is **not** correct for a 2p orbital?
 - A It is dumbbell shaped
 - B It can hold 6 electrons
 - C It contains electrons with angular momentum quantum number, $l = 1$
 - D There are three possible values for the magnetic quantum number, m

4. Which of the following has the same shape as an ammonia molecule, NH_3 ?
 - A BH_3
 - B CH_3^+
 - C CH_3^-
 - D SiH_4

AH Chemistry: 15th May 2018

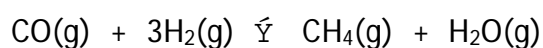
5. Which of the following ligands is bidentate?

- A CN⁻
- B NH₃
- C H₂O
- D H₂NCH₂CH₂NH₂

6. In which of the following does the metal undergo oxidation?

- A VO²⁺ → VO₂⁺
- B MnO₄²⁻ → MnO₂
- C [Co(NH₃)₆]³⁺ → [Co(NH₃)₆]²⁺
- D [Fe(CN)₆]³⁻ → [Fe(CN)₆]⁴⁻

7. The reaction



has an equilibrium constant of 3.9 at 950 °C.

The equilibrium concentrations of CO(g), H₂(g) and H₂O(g) are given in the table.

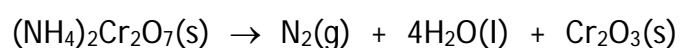
Substance	Equilibrium concentration/mol l ⁻¹
CO(g)	0.500
H ₂ (g)	0.100
H ₂ O(g)	0.040

What is the equilibrium concentration of CH₄(g), in mol l⁻¹, at 950 °C?

- A 0.049
- B 0.200
- C 4.90
- D 20.0

8. An acid is a substance which
- A donates a proton leaving a conjugate acid
 - B donates a proton leaving a conjugate base
 - C accepts a proton leaving a conjugate acid
 - D accepts a proton leaving a conjugate base.
9. What is the approximate pH of a 0.1 mol l⁻¹ ethanoic acid solution?
- A 1.0
 - B 1.9
 - C 2.9
 - D 5.3
10. Which of the following would not be suitable as a buffer solution?
- A Boric acid and sodium borate
 - B Nitric acid and sodium nitrate
 - C Benzoic acid and sodium benzoate
 - D Propanoic acid and sodium propanoate

11. The equation for the decomposition of ammonium dichromate is



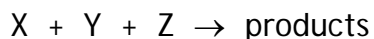
Consider the following data for the reaction at 298 K.

Substance	$\Delta H_f^\circ/\text{kJ mol}^{-1}$	$S^\circ/\text{J K}^{-1} \text{mol}^{-1}$
$(\text{NH}_4)_2\text{Cr}_2\text{O}_7(\text{s})$	-1806	336
$\text{N}_2(\text{g})$	0	192
$\text{H}_2\text{O}(\text{l})$	-286	70
$\text{Cr}_2\text{O}_3(\text{s})$	-1140	81

For the decomposition of ammonium dichromate, calculate

- (a) ΔH°
- (b) ΔS°
- (c) ΔG°

12. The following data refer to initial reaction rates obtained for the reaction



Experiment	Relative concentrations			Relative rate
	[X]	[Y]	[Z]	
1	1.0	1.0	1.0	0.3
2	2.0	1.0	1.0	0.6
3	1.0	2.0	1.0	0.3
4	1.0	1.0	2.0	1.2

These data fit the rate equation

- A Rate = $k[X]^2$
- B Rate = $k[X][Y]^2$
- C Rate = $k[X][Z]^2$
- D Rate = $k[X][Y][Z]$.

13. The end-on overlap of two atomic orbitals lying along the axis of a bond is known as

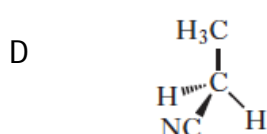
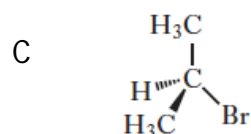
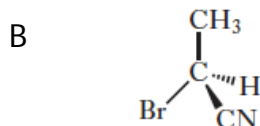
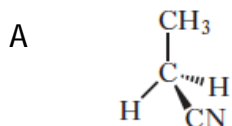
- A a pi bond
- B hybridisation
- C a double bond
- D a sigma bond.

14. Which of the following compounds would be expected to have the highest boiling point?

- A Ethoxypropane
- B Pentan-2-one
- C Pentan-2-ol
- D Pentanal

AH Chemistry: 15th May 2018

15. Which of the following compounds will have an optical isomer?



16. When 2-bromobutane is reacted with potassium cyanide and the compound formed is hydrolysed with dilute acid, the final product is

- A butanoic acid
- B pentanoic acid
- C 2-methylbutanoic acid
- D 2-methylpentanoic acid

17. $\text{C}_3\text{H}_7\text{Cl} + \text{C}_2\text{H}_5\text{O}^- \rightarrow \text{C}_3\text{H}_7\text{OC}_2\text{H}_5 + \text{Cl}^-$

The above reaction is an example of

- A an elimination reaction
- B an electrophilic addition reaction
- C an electrophilic substitution reaction
- D a nucleophilic substitution reaction

18. Propene can be produced by heating 1-bromopropane with ethanolic potassium hydroxide.

This reaction is an example of

- A reduction
- B hydrolysis
- C elimination
- D condensation

19. An organic compound with empirical formula C_2H_4O , has major peaks at 1715 cm^{-1} and 3300 cm^{-1} in its infrared spectrum.

The structural formula of the compound could be

- A $CH_3CH_2CH_2COOH$
 - B $CH_3COOCH_2CH_3$
 - C CH_3COOH
 - D CH_3CHO
20. Which of the following is an essential property of a solvent to be used for recrystallisation purposes?
- A Insoluble in water
 - B Low boiling point
 - C Ability to dissolve more solute when hot than when cold
 - D Ability to dissolve more solute when cold than when hot