

Refer to only Periodic Table. No calculators.

Duration: 45 mins

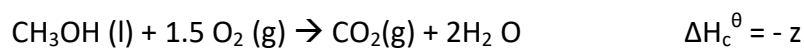
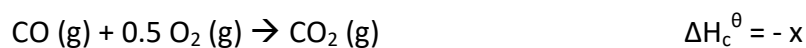
Marks : 30 m

1. How many neutrons are present in 0.12g of  $^{12}\text{C}$ ? (where  $L$  is the Avogadro constant)
  - A. 0.05  $L$
  - B. 0.06  $L$
  - C. 0.02  $L$
  - D. 0.12  $L$
  
2. Which of these samples of gas contains the same number of atoms as 2 g of hydrogen?
  - A. 44 g of carbon dioxide
  - B. 16 g of methane
  - C. 40 g of neon
  - D. 32 g of oxygen
  
3. Which of the following gases exerts the highest pressure?
  - A. 1 mol of  $\text{H}_2$  with a volume of  $1\text{dm}^3$  at  $27^\circ\text{C}$
  - B. 2 mol of  $\text{N}_2$  with a volume of  $0.5\text{dm}^3$  at  $57^\circ\text{C}$
  - C. 1 mol of  $\text{CO}$  with a volume of  $1\text{dm}^3$  at  $27^\circ\text{C}$
  - D. 2 mol of  $\text{CO}_2$  with a volume of  $1\text{dm}^3$  at  $27^\circ\text{C}$
  
4. Which one of the following determines how an element has been positioned in the Periodic Table?
  - A. Mass number
  - B. First ionization energy
  - C. Electronegativity
  - D. Proton Number
  
5. Which of the following electronic configurations represents an element that forms an ion with a -3 charge?
  - A.  $1s^2 2s^2 2p^6 3s^2 3p^4$
  - B.  $1s^2 2s^2 2p^6 3s^2 3p^3$
  - C.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
  - D.  $1s^2 2s^2 2p^6 3s^2 3p^1 3d^2 4s^2$

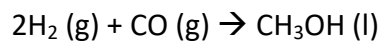
6. Which electronic transition of the hydrogen emission spectrum releases the least energy?
- A.  $n = 1 \rightarrow n = 2$
  - B.  $n = 8 \rightarrow n = 7$
  - C.  $n = 4 \rightarrow n = 2$
  - D.  $n = 9 \rightarrow n = 1$
7. Which one of the following has the largest radius?
- A. Phosphide ion
  - B. Chloride
  - C. Neon
  - D. Potassium ion
8. Which of the following dissolves in water to produce the lowest pH?
- A.  $\text{CO}_2$
  - B.  $\text{SiO}_2$
  - C.  $\text{Cl}_2\text{O}_7$
  - D.  $\text{P}_4\text{O}_{10}$
9. A mixture of two oxides from period 3 is dissolved in water to produce a neutral solution. What could be the components of the mixture?
- A.  $\text{Na}_2\text{O}$  and  $\text{MgO}$
  - B.  $\text{Na}_2\text{O}$  and  $\text{P}_4\text{O}_{10}$
  - C.  $\text{Cl}_2\text{O}_7$  and  $\text{CO}_2$
  - D.  $\text{SO}_3$  and  $\text{CO}_2$
10. Which of the type of bond needs to be broken for magnesium oxide to melt?
- A. Dative co-ordinate
  - B. Ionic Bonds
  - C. Metallic
  - D. Covalent

11. Which of the following explains why copper wire is able to conduct electricity when a potential difference is applied?
- A. The copper (II) ions are able to move and behave like charge carriers.
  - B. The copper atoms are able to move and behave like charge carriers.
  - C. The copper atoms become ionized.
  - D. Sea of delocalized electrons are able to move and behave like charge carries.
12. What is the bond angle of the carbon oxygen bond in carbon dioxide?
- A.  $120^\circ$
  - B.  $180^\circ$
  - C.  $109.5^\circ$
  - D.  $104.5^\circ$

13. Given the following enthalpy changes of combustion :

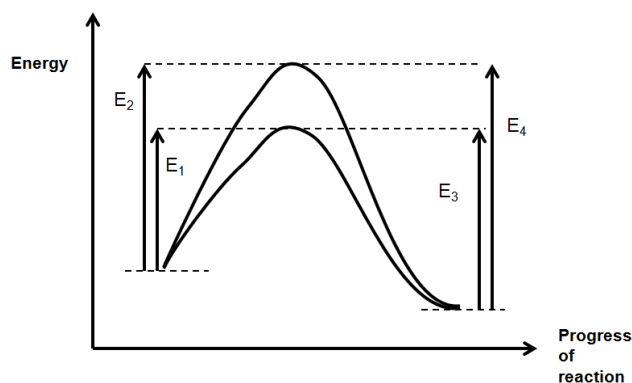


What is the enthalpy change of the following reaction?



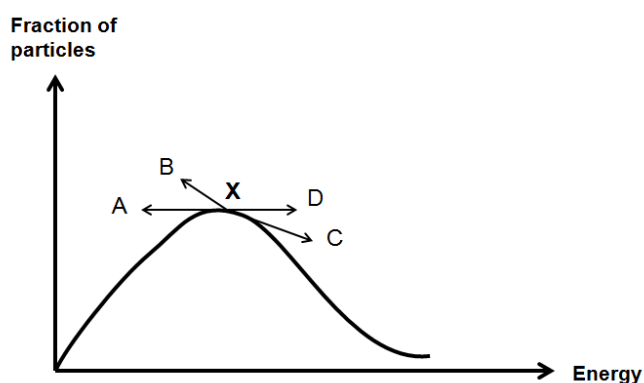
- A.  $(-x) + 2(-y) - (-z)$
- B.  $(x) + 2(-y) - (-z)$
- C.  $(-x) + 2(y) + (-z)$
- D.  $(x) + 2(-y) + (z)$

14. The energy diagram below represents the energy changes that occur with and without a catalyst for a particular reaction.



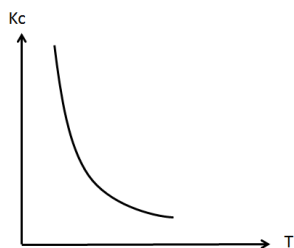
Identify the correct statement out of the following:

- A. The forward reaction with or without catalyst is endothermic.
  - B. The enthalpy change of the reaction  $E_1 - E_3$
  - C. The use of catalyst lowers the enthalpy change of the reaction.
  - D.  $E_1$  is the activation energy of the catalysed backward reaction.
15. The Boltzmann distribution of the speeds of the molecules of a gas diagram is represented below. In which direction does point X change when the gas is heated?



16. Based on the definition of the rate of reaction, state the units of the rate of a reaction?
- A.  $\text{mol}^{-1} \text{dm}^3$
  - B. s
  - C.  $\text{s}^{-1}$
  - D.  $\text{mol dm}^{-3} \text{s}^{-1}$

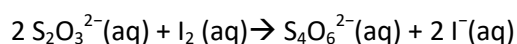
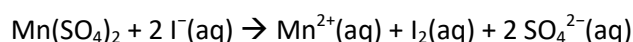
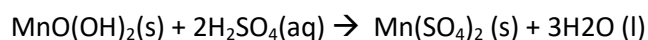
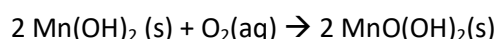
17. The equilibrium constant  $K_c$  for the reaction  $A(g) + B(g) \rightleftharpoons C(g)$  is found to have the following relationship with temperature  $T$  as reflected in the diagram below.



Which of the following conclusions can be obtained from the diagram above?

- A. The reaction is endothermic in the forward direction
  - B. The reaction is exothermic in the backward direction
  - C. At high temperatures, the products are in higher concentrations than reactants.
  - D. At low temperatures, the products are in higher concentrations than reactants.
18. Which one of the following statements about the manufacture of ammonia through the Haber process is true?
- A. The catalyst used increases the percentage yield of ammonia produced.
  - B. A low temperature is used as the forward reaction is exothermic
  - C. A low pressure is used as there are more gaseous molecules on the product side.
  - D. The product yield is dependent on the amount of catalyst added.
19. Which one of the following correctly describes the components of ammonia solution in water?
- A. Only simple molecules.
  - B. Simple molecules and hydrogen-bonded molecules.
  - C. Simple molecules, hydrogen-bonded molecules and ions.
  - D. Hydrogen bonded molecules and ions.
20. Which one of the following describes Bronstead-Lowry acid behavior of ammonia?
- A.  $NH_3(l) + Li(s) \rightarrow (NH_2)^- Li^+ + 0.5 H_2$
  - B.  $6NH_3(l) + Cu^{2+}(aq) \rightarrow [Cu(NH_3)_6]^{2+}$
  - C.  $NH_3(g) + H_2O(l) \rightarrow NH_4^+(aq) + OH^-(aq)$
  - D.  $NH_3(g) + HCl(aq) \rightarrow NH_4Cl(aq)$

21. Which one of the following is the correct equation describing acid rain formation?
- $\text{NO (g)} + \text{H}_2\text{O (l)} \rightarrow \text{H}_2\text{NO}_2 \text{ (aq)}$
  - $\text{CO (g)} + \text{H}_2\text{O (l)} \rightarrow \text{H}_2\text{CO}_2 \text{ (aq)}$
  - $\text{SO}_3 \text{ (g)} + \text{H}_2\text{O (l)} \rightarrow \text{H}_2\text{SO}_4 \text{ (aq)}$
  - $\text{Cl}_2 \text{ (g)} + \text{H}_2\text{O (l)} \rightarrow \text{HCl (aq)} + \text{HClO (aq)}$
22. An aqueous solution containing 4 mol of chlorine ( $\text{Cl}_2$ ) molecules are reduced by 1 mol of thiosulphate ( $\text{S}_2\text{O}_3^{2-}$ ) ions. What is oxidation state of sulfur in the final product of this reaction?
- 0
  - +4
  - +6
  - +2
23. What is the maximum mass of magnesium metal formed at the cathode during the electrolysis of molten magnesium oxide when 4 mols of electrons are passed through the electrolytic system?
- 12.15 g
  - 24.31 g
  - 48.62 g
  - 6.088 g
24. The following equations describe the Winkler method of obtaining the dissolved oxygen concentration in water.



Calculate the amount of dissolved oxygen (in mol) given the volume of thiosulphate  $\text{S}_2\text{O}_3^{2-}$  needed for this reaction is  $100 \text{ cm}^3$  from a concentration of  $0.1 \text{ mol dm}^{-3}$ .

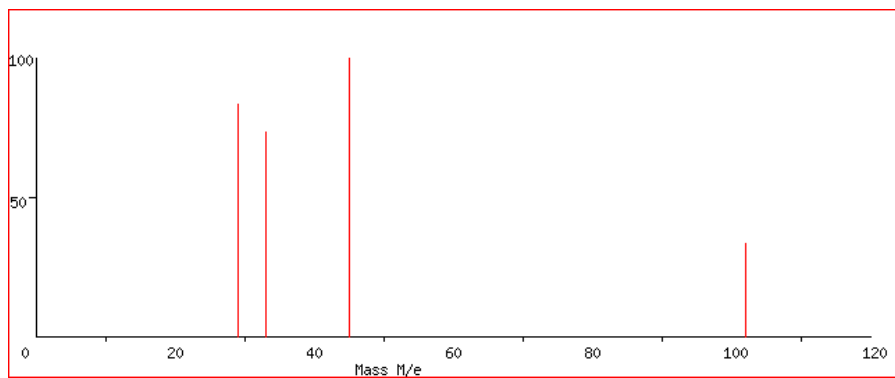
- 0.040 mol
- 0.0025 mol
- 0.250 mol
- 0.40 mol

25. Which one of the following hydrocarbon can decolourise aqueous bromine?
- A.  $\text{C}_2\text{H}_6$   
B.  $\text{C}_2\text{H}_4$   
C.  $\text{C}_2\text{H}_2$   
D.  $\text{C}_3\text{H}_8$
26. Which one of the following can be deduced when propan-2-ol undergoes reaction with acidified potassium dichromate under reflux?
- A. Propanoic acid is formed with a colour change from orange to green.  
B. Propanoic acid is formed with a colour change from green to orange.  
C. Propanone is formed with a colour change from orange to green.  
D. Propanone is formed with a colour change from green to orange.
27. Which one of the following is a substitution reaction?
- A.  $\text{CH}_3\text{Cl} + \text{OH}^- \rightarrow \text{CH}_3\text{OH} + \text{Cl}^-$   
B.  $\text{CH}_2\text{CH}_2 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$   
C.  $\text{CH}_3\text{COCH}_3 + \text{HCN} \rightarrow \text{CH}_3\text{C}(\text{OH})(\text{CN})\text{CH}_3$   
D.  $\text{CH}_2\text{CH}_2 + \text{HCl} \rightarrow \text{C}_2\text{H}_5\text{Cl}$
28. The following table represents the use of a thermometer to measure the temperature rise for an exothermic reaction. What is the temperature rise?

	Temperature/ $^{\circ}\text{C}$ ( $\pm 0.1$ )
Initial Temperature	28.2
Final Temperature	40.1

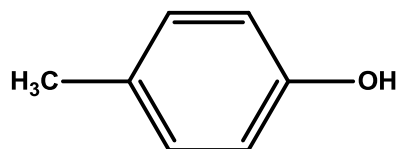
- A.  $11.9 \pm 0.2^{\circ}\text{C}$   
B.  $11.9 \pm 0.1^{\circ}\text{C}$   
C.  $11.9^{\circ}\text{C}$   
D. None of the above

29. Which compound is represented by the following mass spectrum?



- A. Propyl Ethanoate
- B. Pentanol
- C. Ethyl Propanoate
- D. Ethanoic acid

30. How many  $^1\text{H}$  NMR signals will be detected for the following compound :



- A. 3
- B. 4
- C. 5
- D. 6