

CHEM1001 Example Multiple Choice Questions

The following multiple choice questions are provided to *illustrate* the type of questions used in this section of the paper and to provide you with extra practice.

It is *not* a sample quiz. The questions in the paper will be in the style of these questions but may well cover different topics.

In the exam, the answer should be indicated by clearly circling the letter next to the choice you make **and** by filling in the corresponding box on the computer-marked sheet provided. The marks for each correct answer are given beside each question.

Instructions for use of the computer sheet. Draw a **thick** line through the **centre** and crossing both edges of each box selected, as in this example.



Use a **dark** lead pencil so that you can use an eraser if you make an error. Errors made in ink cannot be corrected – you will need to ask the examination supervisor for another sheet. Boxes with faint or incomplete lines or not completed in the prescribed manner may not be read. Be sure to complete the SID and name sections of the sheet.

Your answer as recorded on the sheet will be used in the event of any ambiguity.

There is only one correct choice for each question.

Negative marks will not be awarded for any question.

	Marks
1. Which one of the following best defines the word "allotropes"? A Different structural forms of an element B A pair of substances that differ by H^+ C Elements that possess properties intermediate between those of metals and non-metals D Atoms of a given atomic number that have a specific number of neutrons E The different phases (solid, liquid or gas) of a substance	1
2. How many electrons are there in the valence shell of the O^{2-} ion? A 2 B 8 C 10 D 16 E 18	1
3. What is the formula of the compound formed between magnesium and oxygen? A MgO B Mg_2O_2 C Mg_2O_3 D MgO_2 E Mg_2O	1
4. Which one of the following statements concerning elements in the Periodic Table is correct? A Elements of the same group all have the same number of electrons in the outermost occupied electron shell. B Elements of Group 16 occur as cations in ionic compounds. C Oxides of elements in Groups 16 and 17 are basic. D The halogens (Group 17) are all gases at room temperature. E The Group 13 elements are all metals.	1
5. ^{222}Rn is unstable and decays by losing 6 neutrons and 2 protons. What is the final decay product? A ^{218}Bi B ^{216}Bi C ^{216}Pb D ^{214}Po E ^{212}Tl	1

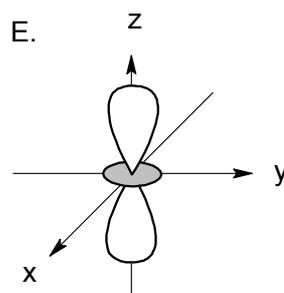
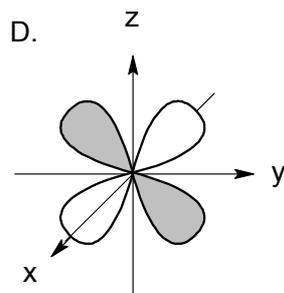
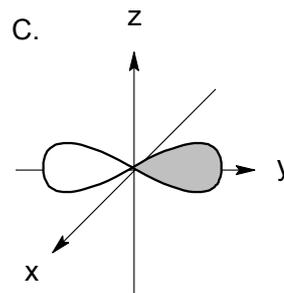
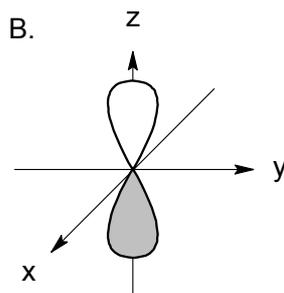
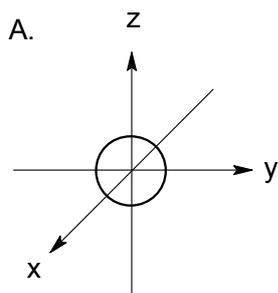
<p>6. Which one of the following species has the least number of electrons?</p> <p>A $^{35}_{17}\text{Cl}$</p> <p>B $^{39}_{18}\text{Ar}$</p> <p>C $^{40}_{18}\text{Ar}$</p> <p>D $^{40}_{20}\text{Ca}^{2+}$</p> <p>E $^{35}_{17}\text{Cl}^{-}$</p>	<p>Marks 1</p>
<p>7. Which one of the following pairs are isotopes?</p> <p>A O_2 and O_3</p> <p>B $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$</p> <p>C $\text{I}_2(\text{g})$ and $\text{I}_2(\text{s})$</p> <p>D Mg^{2+} and Ne</p> <p>E F^{+} and F^{-}</p>	<p>1</p>
<p>8. Which one of the following describes the major intermolecular force in $\text{I}_2(\text{s})$?</p> <p>A covalent bonds</p> <p>B ionic bonds</p> <p>C hydrogen bonds</p> <p>D dispersion forces</p> <p>E dipole-dipole forces</p>	<p>1</p>
<p>9. How many protons (p), neutrons (n) and electrons (e) are present in $^{200}_{80}\text{Hg}^{2+}$?</p> <p>A 200 p 80 n 198 e</p> <p>B 80 p 120 n 78 e</p> <p>C 120 p 80 n 118 e</p> <p>D 80 p 200 n 78 e</p> <p>E 120 p 200 n 118 e</p>	<p>1</p>
<p>10. Which symbol correctly represents an isotope with 14 protons and 15 neutrons?</p> <p>A $^{15}_{14}\text{Si}$</p> <p>B $^{29}_{14}\text{P}$</p> <p>C $^{30}_{15}\text{P}$</p> <p>D $^{29}_{14}\text{Si}$</p> <p>E $^{29}_{15}\text{P}$</p>	<p>1</p>

	Marks
11. How many bonding and non-bonding electron pairs are found in the BF_3 molecule? A 1 bonding and 3 non-bonding B 2 bonding and 2 non-bonding C 3 bonding and 1 non-bonding D 3 bonding and 0 non-bonding E 4 bonding and 0 non-bonding	1
12. Which one of the following pairs of atoms would form a non-polar covalent bond? A C and O B N and O C Cl and Cl D Na and Cl E Ne and Ne	1
13. Which one of the following species has the same electron configuration as the Al^{3+} cation? A F^- B Cl^- C S^{2-} D O^- E Mg^+	1
14. Which one of the following elements has valence electrons in the $n = 3$ shell? A beryllium B oxygen C silicon D neon E hydrogen	1
15. Which one of the following species contains a polar covalent bond? A oxygen B carbon dioxide C sodium chloride D magnesium fluoride E helium	1

Marks

1

16. Which one of the following structures represents a $2p_z$ atomic orbital?



17. What is the oxidation number of phosphorus in KH_2PO_4 ?

- A -VI
- B -II
- C 0
- D +V
- E +VI

1

18. Which force is most important in allowing ammonia, NH_3 , to dissolve in water?

- A hydrogen bonding
- B dipole-induced dipole
- C ion-dipole
- D dipole-dipole
- E ionic

1

19. Which one of the following substances will form strong hydrogen bonds?

- A HCOOH
- B CH_3CN
- C CCl_4
- D SiH_4
- E CH_3OCH_3

1

Marks
1

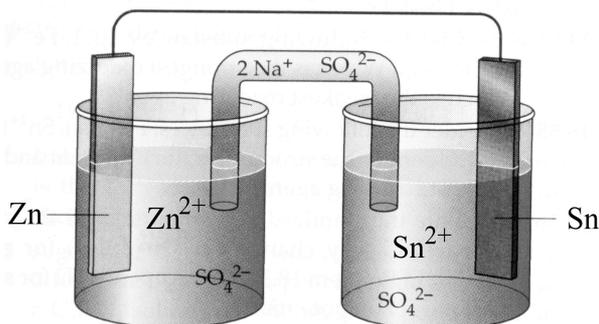
20. Which one of the following statements regarding a catalyst is *not correct*?
- A An enzyme is a catalyst that only binds certain substrates.
 - B An enzyme is a protein that is a highly efficient catalyst for one or more chemical reactions in a living system.
 - C Catalysts increase the rate of a reaction by altering the mechanism, thereby increasing the activation energy.
 - D Catalysts do not alter the equilibrium constant for a chemical reaction.

1

21. Which one of the following statements is *not correct*?
- A Since voltage depends on concentrations, using standard conditions makes it easier to compare different electrochemical reactions.
 - B We have to measure the cell potential to obtain the difference in potential energy because the potential of half-reactions cannot be measured directly.
 - C The direction of a redox reaction can only be determined experimentally.
 - D Half-cell potentials for half-reactions are determined by combining the relevant half-cell with a standardised half-cell.

1

22. The figure below shows a $\text{Zn}^{2+}|\text{Zn}$ and $\text{Sn}^{2+}|\text{Sn}$ voltaic cell. Relevant electrode potentials are on the separate data sheet.



Which one of the following best describes the chemical operation of the cell?

- A The Zn electrode is the cathode; Zn is being oxidised; electrons travel from right to left.
- B The Zn electrode is the anode; Zn is being oxidised; electrons travel from left to right.
- C The Sn electrode is the anode; Zn^{2+} is being reduced; electrons travel from left to right.
- D The Sn electrode is the cathode; Sn is being oxidised; electrons travel from right to left.
- E The Zn electrode is the anode; Sn^{2+} is being reduced; electrons travel from right to left.

Marks

Questions 23-24 refer to the following reaction.

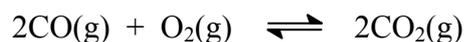


The equilibrium constant for this reaction at 830 °C is 0.25 atm⁻¹.

<p>23. Which one of the following is the correct expression for the equilibrium constant?</p> <p>A $K_c = \frac{[\text{SO}_3]}{[\text{SO}_2][\text{O}_2]}$</p> <p>B $K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2[\text{O}_2]}$</p> <p>C $K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2][\text{O}_2]}$</p> <p>D $K_c = \frac{[\text{SO}_2][\text{O}_2]}{[\text{SO}_3]}$</p> <p>E $K_c = \frac{[\text{SO}_2]^2[\text{O}_2]}{[\text{SO}_3]^2}$</p>	1
<p>24. If the temperature is increased the amount of $\text{SO}_3(\text{g})$ produced will:</p> <p>A increase.</p> <p>B decrease.</p> <p>C remain the same.</p>	1
<p>25. Which one of the following statements most accurately relates the properties of a liquid at room temperature with its vapour pressure?</p> <p>A A liquid with a low vapour pressure will probably have a high surface tension and a high boiling point.</p> <p>B A liquid with a low vapour pressure will probably have a low surface tension and a high boiling point.</p> <p>C A liquid with a high vapour pressure will probably have a low surface tension and a high boiling point.</p> <p>D A liquid with a low vapour pressure will probably have high intermolecular forces and a low boiling point.</p> <p>E A liquid with a high vapour pressure will probably have high intermolecular forces and a low boiling point.</p>	1
<p>26. The reaction $\text{A} \rightleftharpoons \text{B}$ has an equilibrium constant of $K = 10^{-4}$. Which one of the following statements is always correct?</p> <p>A The reaction will have 50% product B and 50% reactant A at equilibrium.</p> <p>B The reaction is very favourable and will have mostly product B at equilibrium.</p> <p>C The reaction is unfavourable and will not have very much product B at equilibrium.</p> <p>D The equilibrium constant only relates to the speed of a reaction and not to the amount of product formed.</p> <p>E The reaction is at equilibrium.</p>	Marks 1

27. What happens when a catalyst is added to a system at equilibrium?	1
A The reaction follows an alternative pathway of lower activation energy. B The heat of reaction decreases. C The potential energy of the reactants decreases. D The potential energy of the products decreases. E The rate of chemical reaction decreases.	
28. In which one of the following reactions will the point of equilibrium shift to the left when the pressure on the system is increased?	1
A $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ B $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ C $2Mg(s) + O_2(g) \rightleftharpoons 2MgO(s)$ D $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$ E $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(l)$	
29. Identify the INCORRECT statement below regarding chemical equilibrium.	1
A All chemical reactions are, in principle, reversible. B Equilibrium is achieved when the forward reaction rate equals the reverse reaction rate. C Equilibrium is achieved when the concentrations of species become constant. D Equilibrium is achieved when the reaction quotient, Q , equals the equilibrium constant. E Equilibrium is achieved when reactant and product concentrations are equal.	

Questions 30 and 31 refer to the following reaction.



Marks

30. What is the equilibrium constant expression, K_c , for this reaction?

A $K_c = k[\text{CO}]^2[\text{O}_2]$

B $K_c = \frac{[\text{CO}]^2[\text{O}_2]}{[\text{CO}_2]}$

C $K_c = \frac{[\text{CO}_2]}{[\text{CO}][\text{O}_2]}$

D $K_c = \frac{[\text{CO}_2]^2}{[\text{CO}]^2[\text{O}_2]}$

E $K_c = \frac{[\text{CO}]^2[\text{O}_2]}{[\text{CO}_2]^2}$

31. Suppose the equation is rewritten as $\text{CO}(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g})$ with an equilibrium constant K_c' . What is the relationship between K_c and K_c' ?

A $K_c' = K_c$ (*i.e.* no change)

B $K_c' = (K_c)^{1/2}$

C $K_c' = \frac{1}{2}(K_c)$

D $K_c' = (K_c)^2$

E $K_c' = (K_c)^{-1}$

32. The following reaction is at equilibrium.



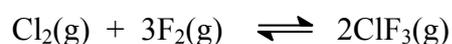
How will the system respond if the temperature is decreased?

A The reaction will shift to the **left**.

B The reaction will shift to the **right**.

C There will be **no change** to the equilibrium position.

33. The following reaction is at equilibrium.



How will the system respond if the volume is increased at constant temperature?

A The reaction will shift to the **left**.

B The reaction will shift to the **right**.

C There will be **no change** to the equilibrium position.

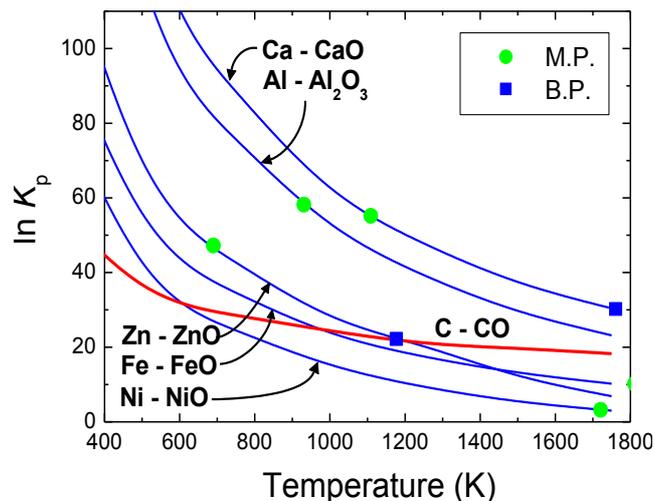
<p>34. Which one of the following species contains an unpaired electron?</p> <p>A N₂ B N₂O C NO₂ D NO₃⁻ E N₂O₄</p>	<p>Marks 1</p>
<p>35. Consider the following reaction.</p> $2\text{SO}_3(\text{g}) \rightarrow 2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \quad \Delta H = 198 \text{ kJ mol}^{-1}$ <p>Which one of the following statements is correct?</p> <p>A The reaction is exothermic. B The reaction container would feel warm. C 198 kJ of energy is given off as 2.00 g of SO₃ reacts. D 198 kJ of energy is needed to produce 2.00 mol of SO₂.</p>	<p>1</p>
<p>36. Which of the following equilibria would be affected by volume changes at constant temperature?</p> <p>1. C₂H₄(g) + H₂(g) ⇌ C₂H₆(g) 2. 4NH₃(g) + 5O₂(g) ⇌ 4NO(g) + 6H₂O(l) 3. SO₃(g) + NO(g) ⇌ NO₂(g) + SO₂(g)</p> <p>A 3 only B 1 and 2 only C 1 and 3 only D 2 and 3 only E all of them</p>	<p>1</p>
<p>37. Which one of the following sets of substances is ranked in order of increasing boiling point at 1 atm?</p> <p>A CH₄ < CF₄ < CH₃OH < CH₃CH₂OH B He < Ar < Kr < Ne C H₂O < H₂S < H₂Se < H₂Te D HF < HCl < HBr < HI E SbH₃ < AsH₃ < PH₃ < NH₃</p>	<p>1</p>

Marks
1

38. How does the volume of 1 mol of an ideal gas change if the temperature and the pressure are both decreased by a factor of four?
- A** decreases by four times
B decreases by sixteen times
C increases by four times
D increases by sixteen times
E remains unchanged

1

39. Consider the “Ellingham diagram” below. Which metal(s) in the diagram can be extracted at 1100 K using coke as a reducing agent?



- A** Ca, Al
B Ca, Al, Zn, Fe
C Zn, Fe
D Zn, Fe, Ni
E Ni

40. What is the correct solubility product expression for Ag₃PO₄?

- A** $K_{sp} = [3Ag^+]^3[PO_4^{3-}]$
B $K_{sp} = [Ag^+]^3[PO_4^{3-}]$
C $K_{sp} = [Ag^+][PO_4^{3-}]$
D $K_{sp} = 3[Ag^+]^3[PO_4^{3-}]$
E $K_{sp} = [Ag^+][PO_4^{3-}]^3$

1

Answers

Question	1	2	3	4	5	6	7	8	9	10
Answer	A	B	A	A	D	A	B	D	B	D

Question	11	12	13	14	15	16	17	18	19	20
Answer	D	C	A	C	B	B	D	A	A	C

Question	21	22	23	24	25	26	27	28	29	30
Answer	C	B	C	B	A	C	A	B	E	D

Question	31	32	33	34	35	36	37	38	39	40
Answer	B	A	A	C	D	B	A	E	D	B