

CHEM1405 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
<p>1. Which of the following is the empirical formula for acetic acid?</p> <p>A CH₃CO₂H B CH₃COOH C C₂H₄O₂ D CH₂O E H₃CCOOH</p> <div style="text-align: center;"><p>acetic acid</p></div>	1
<p>2. Which of the following water solutions has the highest osmotic pressure at 25 °C?</p> <p>A 1 M glucose B 1 M sodium chloride C 1 M acetic acid D 0.5 M aluminium sulfate E 0.5 M sodium chloride</p>	1
<p>3. Which one of the following species contains the greatest number of lone pairs of electrons?</p> <p>A H₂O B NH₃ C H₃O⁺ D HF E CH₄</p>	1
<p>4. Which species has the electron configuration 1s² 2s² 2p⁶ 3s² 3p⁶?</p> <p>A K⁺ B F₂ C N D F⁻ E Ne</p>	1
<p>5. A biological colloid is prevented from coagulating by:</p> <p>A steric (polymeric) stabilisers only. B electrostatic stabilisers only. C charged species bound to the surface only. D both steric (polymeric) and electrostatic stabilisers. E charged species present in the continuous (water) phase only.</p>	1

Marks
1

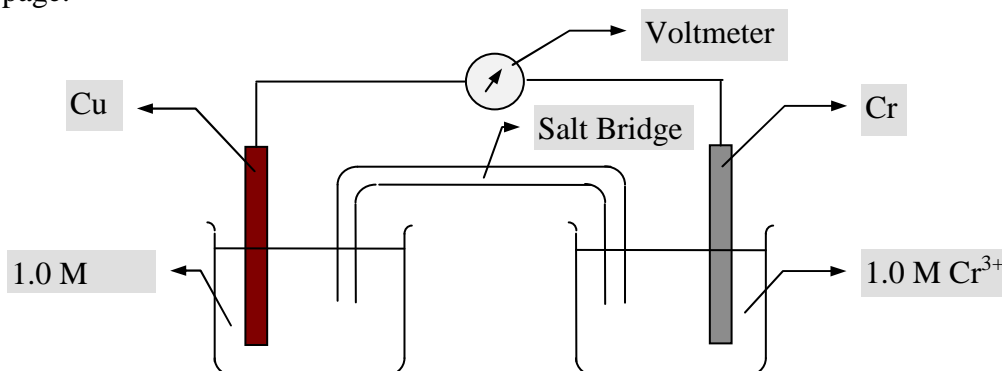
6. Which of the following is not an example of a colloid?

- A milk
 B paint
 C blood
 D an isotonic solution
 E a 'puffer' for asthmatics

17. The enthalpy change for the reaction $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$ is -54 kJ mol^{-1} . What effect will increasing the temperature at constant pressure have on this equilibrium reaction?

- A cannot be predicted
 B shift to the left (reactants)
 C shift to the right (products)
 D no change

Questions 8 - 11 refer to the diagram below and the list of reduction potentials on the data page.



8. Which of the following reactions is the reduction process occurring in this cell?

- A There will be no spontaneous reduction process.
 B $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$
 C $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$
 D $\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Cr}(\text{s})$
 E $\text{Cr}(\text{s}) \rightarrow \text{Cr}^{3+}(\text{aq}) + 3\text{e}^-$

1

9. Which of the following reactions is the overall reaction occurring in this cell?

- A $\text{Cu}^{2+}(\text{aq}) + \text{Cr}(\text{s}) \rightarrow \text{Cu}(\text{s}) + \text{Cr}^{3+}(\text{aq})$
 B $\text{Cr}^{3+}(\text{aq}) + \text{Cu}(\text{s}) \rightarrow \text{Cr}(\text{s}) + \text{Cu}^{2+}(\text{aq})$
 C $3\text{Cu}^{2+}(\text{aq}) + 2\text{Cr}(\text{s}) \rightarrow 3\text{Cu}(\text{s}) + 2\text{Cr}^{3+}(\text{aq})$
 D $2\text{Cr}^{3+}(\text{aq}) + 3\text{Cu}(\text{s}) \rightarrow 2\text{Cr}(\text{s}) + 3\text{Cu}^{2+}(\text{aq})$
 E There will be no spontaneous reaction

1

	Marks
10. What would be the reading on the voltmeter when the half-cells are first connected? A 2.50 V B 1.08 V C 0.46 V D 0.40 V E 0.00 V	1
11. What would be the value of E_{cell} at equilibrium? A 2.50 V B 1.08 V C 0.46 V D 0.40 V E 0.00 V	1
12. Which one of the following represents the conjugate acid and the conjugate base of the H_2PO_4^- ion? A Conjugate acid: H_3PO_4 ; conjugate base: HPO_4^{2-} B Conjugate acid: HPO_4^{2-} ; conjugate base: H_3PO_4 C Conjugate acid: H_2PO_4^- ; conjugate base: HPO_4^{2-} D Conjugate acid: HPO_4^{2-} ; conjugate base: PO_4^{3-} E Conjugate acid: H_3PO_4 ; conjugate base: PO_4^{3-}	1
13. Which statement best describes the function of a catalyst in a reaction? A A catalyst makes a reaction more exothermic. B A catalyst increases the reaction rate. C A catalyst increases the yield of products. D A catalyst plays no part in the mechanism of the reaction. E A catalyst lowers the temperature of the reaction.	1
14. Which one of the following statements is always true for a spontaneous process? A $\Delta H < 0$ B $\Delta G > 0$ C $\Delta H - T\Delta S < 0$ D $\Delta H + T\Delta S > 0$	1

Marks

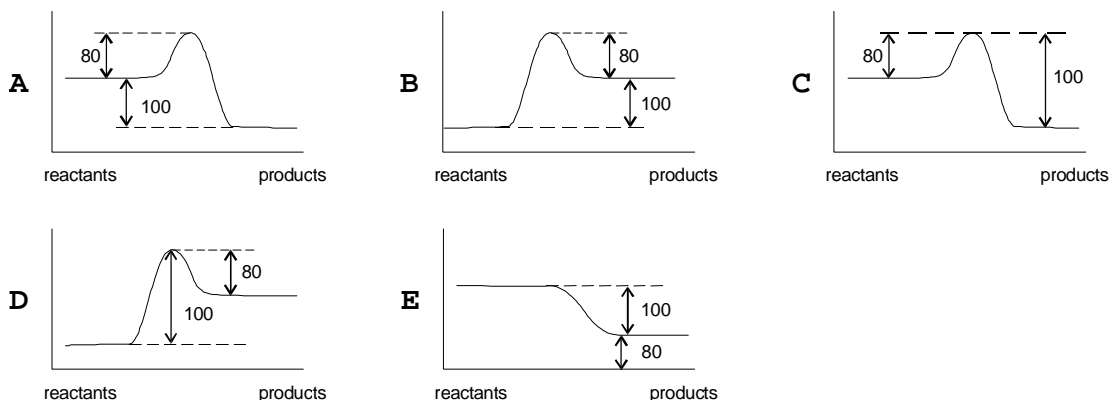
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15. Which one of the following has $\Delta H_f^\circ = 0$ at 298 K?

- A Bi(s)
- B Ar(s)
- C HCl(g)
- D He(l)
- E O₂(l)

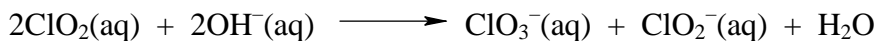
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16. A reaction has an activation energy of 180 kJ mol⁻¹ and an overall energy change of +100 kJ mol⁻¹. In each of the potential energy diagrams shown below, the horizontal axis is the reaction coordinate and the vertical axis is potential energy in kJ mol⁻¹. Which potential energy diagram best describes this reaction?



2

17. Given the initial rate data below, what is the rate law for the following reaction?



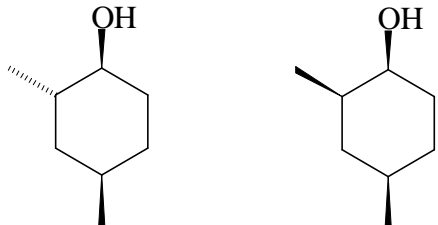
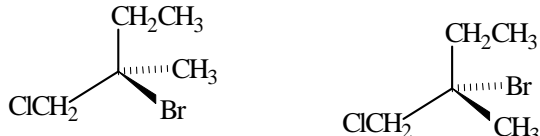


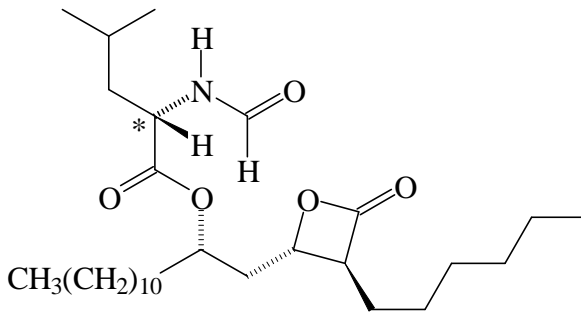
$[\text{ClO}_2]_0 / \text{mol L}^{-1}$	$[\text{OH}^-]_0 / \text{mol L}^{-1}$	Initial rate / $\text{mol L}^{-1} \text{s}^{-1}$
0.060	0.030	0.0248
0.020	0.030	0.00276
0.020	0.090	0.00828

- A rate = $k[\text{ClO}_2]^2$
- B rate = $k[\text{ClO}_2][\text{OH}^-]^2$
- C rate = $k[\text{ClO}_2]^2[\text{OH}^-]^2$
- D rate = $k[\text{ClO}_2]^2[\text{OH}^-]$
- E rate = $k[\text{ClO}_2][\text{OH}^-]$

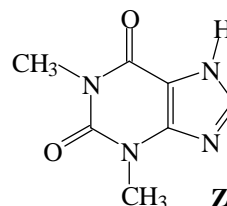
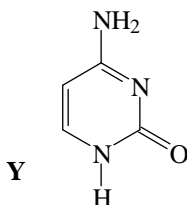
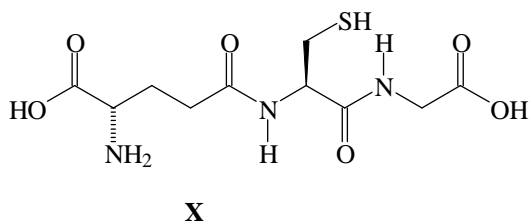
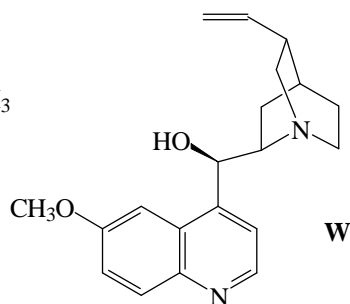
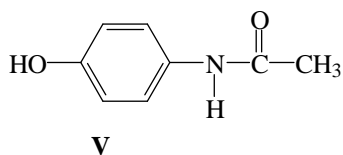
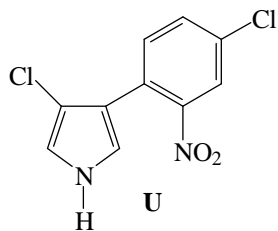
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18. Which one of the following is *false*?

- A $K_w = K_a \times K_b$
- B $\text{p}K_a + \text{p}K_b = 14.00$
- C $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14.00}$ only in pure water at 25 °C.
- D $[\text{H}^+]$ is non-zero even at very high pH.
- E When HCl(g) is dissolved in water, it is still considered to be a strong acid

even at very low concentrations.		
For questions 19 - 22, choose from A - E the term that best describes the isomeric relationship for each of the following pairs of compounds.		Marks
A. Diastereoisomers B. Enantiomers C. Same compound D. Constitutional isomers E. None of the above		
19.		A B C D E
20.		A B C D E
21.		A B C D E
22.		A B C D E
23.	<p>Xenical (orlistat) is a lipase inhibitor for obesity management that acts by inhibiting the absorption of dietary fats. Its structure is shown below.</p> 	1
<p>Which one of the following statements is false?</p> <p>A Orlistat is practically insoluble in water.</p> <p>B Orlistat has no pK_a value within the physiological range.</p> <p>C The carbon labelled (*) has the (<i>R</i>)- configuration.</p> <p>D Orlistat has four stereogenic centres.</p> <p>E Orlistat will not undergo an addition reaction and decolourise bromine water.</p>		

Questions 24 - 27 refer to the following compounds.



24. Which of the compounds will undergo an acid-base reaction with dilute HCl?

1

- A All of them
 B U, V, X and Y
 C U, W, X, Y and Z
 D V, W, X, Y and Z
 E W, X, Y and Z

25. Which of the compounds will undergo an acid-base reaction with dilute NaOH?

1

- A All of them
 B V, W, X and Z
 C V, W and X
 D V and X only
 E X only

26. Which of the compounds will effervesce (bubble) when treated with dilute NaHCO₃ solution?

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- A None of them
 B X only
 C V, W and X
 D W and X only
 E V, W and Z

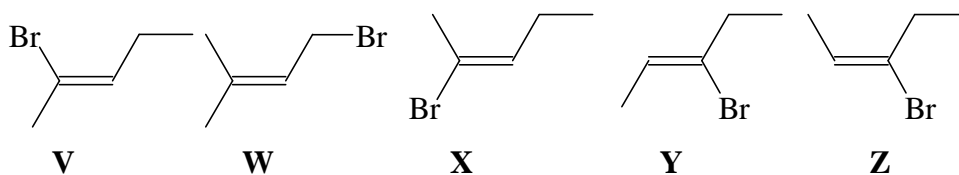
27. How many stereogenic carbon centres are present in compound W (quinine)?

1

- A 2 B 3 C 4 D 5 E 6

28. Which one of the following statements concerning compounds **V** - **Z** is **true**?

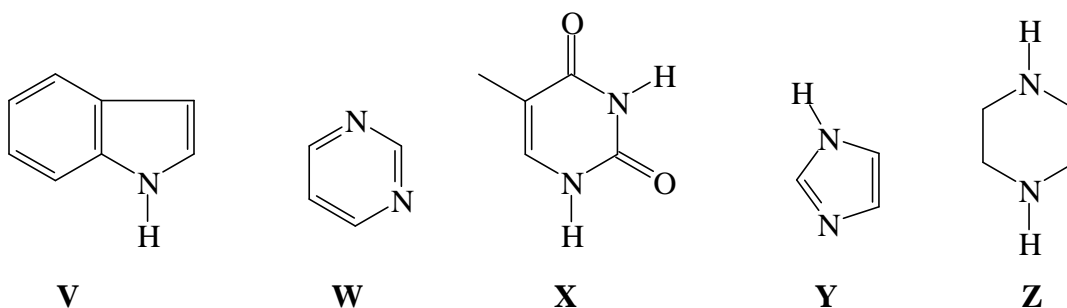
Marks
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- A** **V** and **X** are conformational isomers.
B **Y** and **Z** are constitutional isomers.
C **X** and **Z** are stereoisomers.
D **V** and **Y** are stereoisomers.
E **X** and **Y** are constitutional isomers.

29. Consider the following five compounds. Which one of the following statements is **incorrect**?

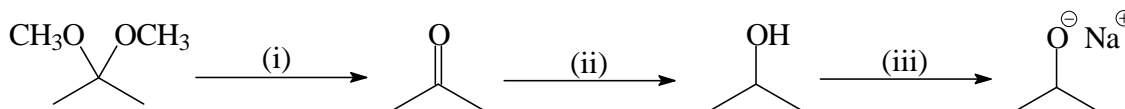
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- A** Compounds **W**, **Y** and **Z** are bases and will dissolve in dilute hydrochloric acid.
B Compounds **V**, **W** and **Y** are aromatic.
C Compound **X** will undergo an addition reaction and decolourise bromine.
D Compounds **X**, **Y** and **Z** can undergo tautomerism.
E Compounds **V**, **W** and **Y** will absorb UV-visible radiation strongly.

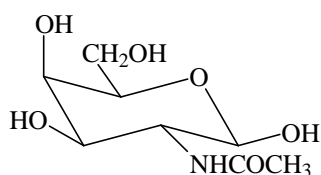
30. The reagents and reaction conditions to carry out the transformations below are:

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- A** (i) dilute acid (ii) NaBH_4 followed by dilute acid (iii) dilute NaOH
B (i) dilute acid (ii) NaBH_4 followed by dilute acid (iii) Na
C (i) dilute acid (ii) $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$ (iii) dilute NaOH
D (i) dilute base (ii) NaBH_4 followed by dilute acid (iii) Na
E (i) dilute base (ii) $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$ (iii) Na

31. The structure of *N*-acetylgalactosamine, a sugar important in blood groups, is shown below.



Which one of the following statements is **false**?

- A The functional groups in *N*-acetylgalactosamine are primary alcohol, hemiacetal, amide and secondary alcohol.
- B *N*-acetylgalactosamine is optically active.
- C *N*-acetylgalactosamine will not give a positive result with Tollens' reagent.
- D *N*-acetylgalactosamine will not undergo an acid base reaction with dilute hydrochloric acid.
- E *N*-acetylgalactosamine is in equilibrium with another cyclic form.

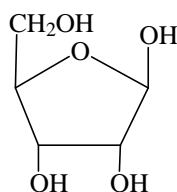
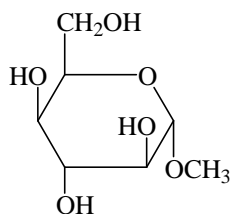
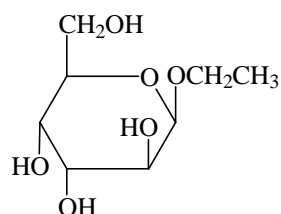
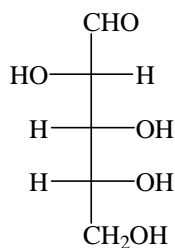
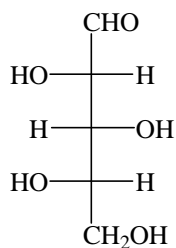
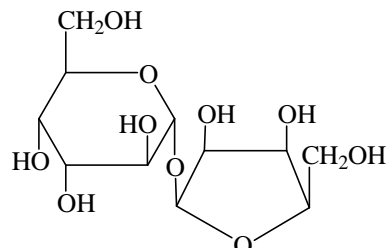
Marks
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32. Which one of the following statements is **incorrect**?

- A The formula of glucose can be written as $C_6(H_2O)_6$.
- B Most naturally occurring sugars have the D-configuration.
- C NAD^+ is a biological reducing agent.
- D Most amino acids present in proteins have the L-configuration.
- E Phenols are stronger acids than alcohols.

1

Questions 33 - 35 refer to the following carbohydrates, **F - K**.

**F****G****H****I****J****K**

33. Which of the sugars **F - K** are reducing sugars?

1

- A** All of them
- B** **F**, **G** and **H** only
- C** **F**, **I** and **J** only
- D** **I** and **J** only
- E** **F**, **I**, **J** and **K** only

34. What is the stereochemical relationship between sugars **I** and **J**?

1

- A** Diastereoisomers
- B** Enantiomers
- C** Constitutional isomers
- D** *Meso*-isomers
- E** Conformational isomers

35. Which of the sugars **F**, **G** and **H** are β -anomers?

1

- A** **G** only
- B** **F** and **G** only
- C** **F** and **H** only
- D** **G** and **H** only
- E** **F**, **G** and **H**

Answers

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

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

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

Question	31	32	33	34	35
Answer	C	C	C	A	C