## **CHEM1612 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.

1.	Whi	ch statement correctly describes Hess's Law?	Marks			
	A	The enthalpy of all reactants in their standard states is defined as zero.	1			
	В	Enthalpy changes may only be calculated if one or more of the reactants is an element.				
	С	The enthalpy change of a reaction is independent of the route taken.				
	D	The enthalpy change of a reaction may only be calculated at 1 atm pressure and 25 $^{\circ}$ C.				
	Ε	Exothermic reactions occur quickly, endothermic reactions occur slowly.				
2.	Which one of the following statements best describes the standard enthalpy of formation of any element?					
	Α	The value of $\Delta H^{\circ}_{f}$ (element) depends on temperature.				
	В	The value of $\Delta H^{\circ}_{f}$ (element) is zero only for elements in the solid state.				
	С	The value of $\Delta H^{\circ}_{f}$ (element) is zero for any element in the standard state.				
	D	The value of $\Delta H^{\circ}_{f}$ (element) is zero only at absolute zero temperature.				
	Е	The value of $\Delta H^{\circ}_{f}$ (element) depends on $S^{\circ}$ for that element.				
3.	<ol> <li>Under which circumstances would a reaction be non-spontaneous at all temperatures?</li> </ol>					
	A	$\Delta H^{\circ}$ negative and $\Delta S^{\circ}$ positive				
	В	$\Delta H^{\circ}$ negative and $\Delta S^{\circ}$ negative				
	С	$\Delta H^{\circ}$ positive and $\Delta S^{\circ}$ negative				
	D	$\Delta H^{\circ}$ positive and $\Delta S^{\circ}$ positive				
	Е	It is impossible to tell without calculating $\Delta G^{\circ}$ .				
4.	In which direction will the following equilibrium shift if a solution of CH <sub>3</sub> CO <sub>2</sub> Na is added?					
		$CH_3COOH(aq) \iff CH_3CO_2^-(aq) + H^+(aq)$				
	Α	shift to the right (more products)				
	В	shift to the left (more reactant)				
	С	no change				
	D	cannot be predicted				
5.	In w equi	which of the following acid / base titrations, can we NOT determine the valence point in an accurate manner?	1			
	A	strong acid / strong base				
	B	strong acid / weak base				
	С	weak acid / strong base				
	D	weak acid / weak base				

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6.	Wha	t is the expression for $K_a$ for the following reaction?	Marks							
		$CH_3COOH(aq) \iff CH_3CO_2^-(aq) + H^+(aq)$	1							
	$\mathbf{A}  K_{\mathbf{a}} = [CH_{3}CO_{2}^{-}(\mathbf{aq})][H^{+}(\mathbf{aq})]/[CH_{3}COOH(\mathbf{aq})]$									
	В	$K_{a} = 2[H^{+}(aq)]/[CH_{3}COOH(aq)]$								
	C	$K_{a} = [H (aq)]^{-/}[CH_{3}COOH(aq)]$ $K_{a} = [CH (COOH(ap)]^{/}[UH^{+}(ap)]^{2}$								
	D	$X_a = [CH_3COOH(aq)]/[H(aq)]$	1							
7.	Ranl	the following 1 M water solutions in order of decreasing freezing point.	1							
	NaC	l glucose CaCl <sub>2</sub> CH <sub>3</sub> COOH Na <sub>3</sub> PO <sub>4</sub>								
		highest freezing point lowest freezing point								
	Α	$NaCl > glucose > CaCl_2 > CH_3COOH > Na_3PO_4$								
	В	$glucose > NaCl > CaCl_2 > CH_3COOH > Na_3PO_4$								
	С	$glucose > NaCl > CH_3COOH > CaCl_2 > Na_3PO_4$								
	D	$glucose > NaCl > CH_3COOH > Na_3PO_4 > CaCl_2$								
	Ε	$glucose > CH_3COOH > NaCl > CaCl_2 > Na_3PO_4$								
8.	Arra	nge the following species from left to right in order of increasing radius.	1							
		Na, Mg, $F^-$ , Na <sup>+</sup> , Mg <sup>2+</sup>								
	<b>A</b> $F^- < Mg^{2+} < Na^+ < Mg < Na$									
	В	<b>B</b> $Na^+ < Mg^{2+} < F^- < Mg < Na$								
	С	$Na^+ < Mg^{2+} < F^- < Na < Mg$								
	D	$Mg^{2+} < Na^+ < F^- < Mg < Na$								
	Ε	$Mg^{2^+} < Mg < Na^+ < Na < F^-$								
9.	What is the [OH <sup>–</sup> ] of a solution with a pH of 9.0?									
	<b>A</b> $1 \times 10^{-5}$ M									
	В	$1 \times 10^{-9} \text{ M}$								
	C	$1 \times 10^{-4} \text{ M}$								
	D	$1 \times 10^{-7} \text{ M}$								
	E	none of the above								
10	Whi	ch of the following statements regarding the solubility of $Mg(OH)_{2}$ is correct?	1							
10.	•••	$\mathbf{H}_{\mathbf{h}} = \mathbf{H}_{\mathbf{h}} = $								
	A D	pH nas no effect on the solubility of $Mg(OH)_2$ .								
	Б	$Mg(OH)_2$ is less soluble in 0.1 M MgCl, solution then in water								
	U N	all of the above								
	Б Б	none of the above								





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19.	Whi	ich one of the following indicators would be most suitable for this titration?	Marks 1			
	A	any acid/base indicator is suitable				
	B	phenolphthalein $(pK_a = 9.6)$				
	С	cresol red $(pK_a = 8.3)$				
	D	methyl red (p $K_a = 5.1$ )				
	Ε	methyl yellow (p $K_a = 3.1$ )				
20.	How many stereoisomers are possible for the complex $[NiCl_2(en)_2]$ ? en = ethylenediamine = $NH_2CH_2CH_2NH_2$					
	Α	1				
	B	2				
	С	3				
	D	4				
	Ε	6				
21.	How en =	w many stereoisomers are possible for the complex $[Ni(en)_3]^{2+}$ ? = ethylenediamine = NH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> NH <sub>2</sub>	1			
	A	1				
	В	2				
	С	3				
	D	4				
	Ε	6				
22.	Wha	at is the solubility constant expression for $Zn_3(PO_4)_2$ ?	1			
	A	$K_{\rm sp} = [Zn^{2+}][PO_4^{3-}]$				
	B	$K_{\rm sp} = [Zn^{2^+}][2PO_4^{3^-}]$				
	С	$K_{\rm sp} = [Zn^{2+}]^3 [PO_4^{3-}]^2$				
	D	$K_{\rm sp} = [3Zn^{2+}]^3 [2PO_4^{3-}]^2$				
	Ε	$K_{\rm sp} = [Zn^{3+}]^2 [PO_4^{2-}]^3$				
23.	Wha	at is the solubility product constant expression for Ag <sub>3</sub> PO <sub>4</sub> ?	1			
	A	$K_{\rm sp} = [{\rm Ag}^+][{\rm PO_4}^{3-}]$				
	B	$K_{\rm sp} = [{\rm Ag}^+] [{\rm PO_4}^{3-}]^3$				
	С	$K_{\rm sp} = [{\rm Ag}^+]^3 [{\rm PO}_4^{3-}]$				
	D	$K_{\rm sp} = [3 {\rm Ag}^+]^3 [{\rm PO}_4^{3-}]$				
	Е	$K_{\rm sp} = 3[{\rm Ag}^+][{\rm PO}_4^{3-}]$				



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27.	Wha	t is the overall reaction occurring in this cell?	Marks					
	A	A There will be no spontaneous reaction.						
	В	$Ni^{2+}(aq) + Cu(s) \rightarrow Ni(s) + Cu^{2+}(aq)$						
	С	$Cu^{2+}(aq) + Ni(s) \rightarrow Cu(s) + Ni^{2+}(aq)$						
	D	$Cu^{2+}(aq) + Ni^{2+}(aq) + 4e^{-} \rightarrow Cu(s) + Ni(s)$						
	E	$Cu(s) + Ni(s) \rightarrow Cu^{2+}(aq) + Ni^{2+}(aq) + 4e^{-}$						
28.	Wha	What would be the value of $E_{cell}$ at equilibrium?						
	A	0.58 V						
	B	0.34 V						
	С	0.24 V						
	D	0.10 V						
	Ε	0.00 V						
29.	Wha	hat is the reading on the voltmeter when the half cells are first connected?						
	A	0.58 V						
	В	0.34 V						
	С	0.24 V						
	D	0.10 V						
	Ε	0.00 V						
30.	Whi	ch electrode is the anode and to which electrode do the electrons flow?	1					
	A	The Ni electrode is the anode; electrons flow to the cathode.						
	В	The Cu electrode is the anode; electrons flow to the cathode.						
	С	The Ni electrode is the anode; electrons flow to the anode.						
	D	The Cu electrode is the anode; electrons flow to the anode						
31.	Ranl	the following series of atoms in order of INCREASING electronegativity. N $O$ $E$ $P$ As	1					
	A	N < O < F < P < As						
	B	F < O < N < P < As						
	C	As < P < N < O < F						
	D	As < P < N < F < O						
	E	F < N < U < AS < P						



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36.	What	at isotope is produced by the $\alpha$ -decay of $\frac{99}{43}$ Tc?	Marks 1		
	A	None - $\frac{99}{43}$ Tc undergoes $\beta^-$ decay			
	B	<sup>99</sup> <sub>42</sub> Mo			
	С	<sup>95</sup> <sub>41</sub> Nb			
	D	<sup>99</sup> <sub>44</sub> Ru			
	E	<sup>103</sup> <sub>45</sub> Rh			
37.	What	at is the oxidation state of Rh in the complex $K_3[Rh(CN)_6]$ ?	1		
	A	+I			
	B	+III			
	С	+VI			
	D	0			
	Е	-III			
38.	What is the oxidation state of Tc in $K_2[TcO(ox)_2]$ ? ox is the oxalate anion, $C_2O_4^{2-}$ .				
	Α	+II			
	B	+III			
	С	+IV			
	D	+V			
	Ε	+VI			
39.	A so follo	olid pharmaceutical dispersed in a carrier gas is an example of which one of the owing?	1		
	A	a gel			
	B	a foam			
	С	an emulsion			
	D	an aerosol			
40.	How	w many isomers are possible for the square planar complex [PtI <sub>2</sub> (NH <sub>3</sub> ) <sub>2</sub> ]?	1		
	A	1			
	B	2			
	С	3			
	D	4			
	E	5			

## Answers

Question	1	2	3	4	5	6	7	8	9	10
Answer	С	С	С	В	D	Α	Е	D	Α	С
Question	11	12	13	14	15	16	17	18	19	20
Answer	D	С	С	Е	С	С	С	D	D	С
Question	21	22	23	24	25	26	27	28	29	30
Answer	В	С	С	D	В	Е	С	Е	Α	А
Question	31	32	33	34	35	36	37	38	39	40
Answer	С	A	D	В	D	A	В	С	D	В