

PRELIM 2014 PAPER 2 QUESTIONS

21 OCTOBER 2014



Lesson Description

In this lesson we:

- Review select questions from Provincial Preliminary Exams – Paper 2



Test Yourself

Select the most correct answer from the options given. Write down only the correct letter

Question 1

A chemical reaction is in a state of dynamic equilibrium when the...

- reactants and products always have the same masses
- concentration of products is zero
- equilibrium constant is zero
- forward and reverse reactions occurs at the same rate

Question 2

The pH of a solution of NaOH is 10,5. Which one of the following statements is CORRECT?

- $[\text{OH}^-] = [\text{H}_3\text{O}^+]$
- $[\text{Na}^+] > [\text{OH}^-]$
- $[\text{H}_3\text{O}^+] < [\text{OH}^-]$
- $[\text{OH}^-] < [\text{H}_3\text{O}^+]$

Question 3

Water undergoes auto-ionisation. During this process...

- a proton is transferred from one water molecule to another
- water molecules acts as proton donors only
- water molecules act as proton acceptors only
- the pH of water will decrease

Question 4

A small quantity of concentrated hydrochloric acid is gradually added to 1 dm^3 of distilled water at 25°C . After testing the resultant solution, it is found that the value of K_w , $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ in $\text{mol}\cdot\text{dm}^{-3}$ are:

A.	$K_w = 10^{-14}$	$[\text{H}_3\text{O}^+] < 10^{-7}$	$[\text{OH}^-] > 10^{-7}$
B.	$K_w < 10^{-14}$	$[\text{H}_3\text{O}^+] < 10^{-7}$	$[\text{OH}^-] < 10^{-7}$
C.	$K_w = 10^{-14}$	$[\text{H}_3\text{O}^+] > 10^{-7}$	$[\text{OH}^-] < 10^{-7}$
D.	$K_w = 10^{-14}$	$[\text{H}_3\text{O}^+] = 10^{-7}$	$[\text{OH}^-] = 10^{-7}$

Question 5

The oxidation number of sulphur in a sulphate (SO_4^{2-}) ion is...

- +8
- +6
- +4
- +2

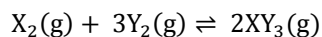


Improve your skills

Question 1

(Adapted from Gauteng Preparatory Exam 2014)

When a number of moles of $X_2(g)$ and $Y_2(g)$ are placed in an empty, closed 2 dm^3 container at 800°C , a reaction takes place and eventually reaches equilibrium according to the following equation:



At equilibrium there is $0,4 \text{ mol}\cdot\text{dm}^{-3}$ of Y_2 and XY_3 present

You are also given the following information for the reaction:

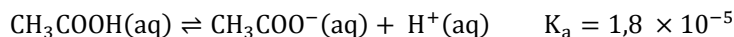
Temperature $^\circ\text{C}$	K_c
400	0,8
600	2,5
800	4,0

- 1.1. Calculate the initial number of moles of X_2 and Y_2 placed in the container. (9)
 - 1.2. Is the forward reaction endothermic or exothermic? (1)
 - 1.3. Explain your answer to Question 1.2. (2)
 - 1.4. What effect will adding more $Y_2(g)$ at 800°C have on the following?
 Answer only INCREASE, DECREASE or STAY THE SAME
 - 1.4.1. The rate of the reverse reaction. (1)
 - 1.4.2. Concentration of $X_2(g)$ (1)
 - 1.5. Which ONE of the following gases XY_3 or X_2 would be present in a higher concentration in equilibrium mixture at 400°C ? (1)
 - 1.6. Explain your answer to Question 1.5. (2)
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Question 2

(Adapted from Gauteng Preparatory Exam Paper 2 2014)

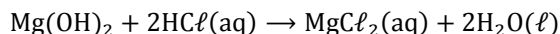
You are given the following ionisation reaction of ethanoic acid in water:



- 2.1. What does the ionisation constant indicate about the strength of the acid? (1)
- 2.2. What is meant by a *concentrated acid*? (2)
- 2.3. H_2PO_4^- is an ampholyte. Write an equation to indicate its role as a base. (2)
- 2.4. Write down a conjugate acid / base pair from your equation in Question 2.3. (1)
- 2.5. Milk of Magnesia has been used over the ages to relieve stomach ailments caused by excess stomach acid. The active ingredient in Milk of Magnesia is magnesium hydroxide ($\text{Mg}(\text{OH})_2$)
 A group of learners prepare a solution of magnesium hydroxide
 - 2.5.1. What mass of $\text{Mg}(\text{OH})_2$ must be dissolved in distilled water to prepare 500 cm^3 of a solution with a concentration of $0,20 \text{ mol}\cdot\text{dm}^{-3}$? (5)
 - 2.5.2. What will the concentration of the hydroxide ions in the solution be? Assume 100% dissociation of magnesium hydroxide in water. (2)

- 2.5.3. The pH of any medicine safe for human consumption must lie between pH = 4 and pH = 9. Will this solution that the learners prepare be safe for human consumption? Show all calculations. (5)
- 2.6. The learners now check the concentration of their solution that they made. They run a titration using hydrochloric acid of concentration $0,1 \text{ mol}\cdot\text{dm}^{-3}$. They transfer 25 cm^3 of the magnesium hydroxide solution into a conical flask.

The balanced chemical equation for this reaction is:



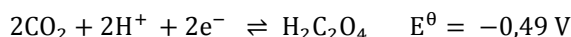
Determine what volume of HCl will be needed to fully neutralise the Milk of Magnesia if the concentration is actually $0,2 \text{ mol}\cdot\text{dm}^{-3}$. (4)

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Question 3

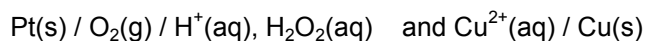
(Adapted from Eastern Cape Preparatory Exam Paper 2 2014)

- 3.1. Consider the following half reaction involving an oxalic acid solution

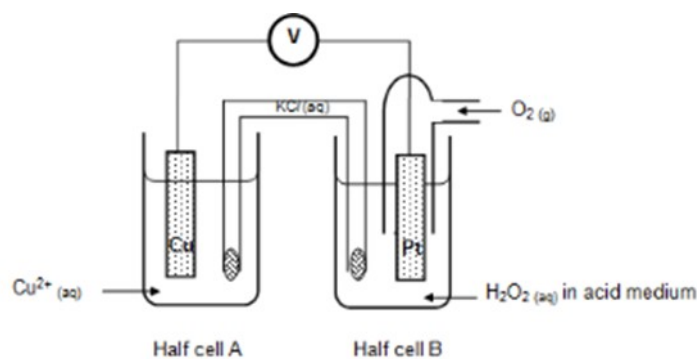


A solution of potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$) is added to an oxalic acid ($\text{H}_2\text{C}_2\text{O}_4(\text{aq})$) solution

- 3.1.1. Explain why the reaction between the solution of oxalic acid and potassium dichromate will be spontaneous. Refer to the relative strengths of the oxidising and reducing agents in your answer. (3)
- 3.1.2. Use half-reactions to write down a balanced equation for the reaction between oxalic acid and potassium dichromate. Leave the answer in ionic form without spectator ions. (4)
- 3.2. A learner sets up a standard electrochemical cell using the following half-cells:



Potassium chloride ($\text{KCl}(\text{aq})$) solution is used in the salt bridge.



- 3.2.1. Which half cell (A or B) contains the cathode? (2)
- 3.2.2. Write down the oxidation half-reaction. (2)
- 3.2.3. Write down the cell notation of this cell. (3)
- 3.2.4. Calculate the potential difference of the cell (E_{cell}^θ) (4)
- 3.2.5. After several days, the reading on the voltmeter is 0,00 V. Explain why this reading is obtained. (4)

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