ParisTech – test 2024 – Part 2 : Chemistry

Question 31

Not yet answered

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General chemistry (+)

We introduce 20 ml of 5 mol L^{-1} HCl into a 1000 ml volumetric flask and fill up to the mark with distilled water. The pH of the resulting solution is

- a. 1
- b. 3
- c. 4
- d. 2
- e. 0

Question 32

Not yet answered

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General chemistry (++)

In an electrolytic cell, a copper (II) solution is maintained under a continuous and constant current of 2 A for one hour. What will be the mass of copper obtained?

- a. $m = 39.6$ mg
- b. $m = 0.66$ mg
- c. $m = 2.37$ mg
- d. $m = 1.32$ mg
- e. $m = 2.37$ g

Question 33

Not yet answered

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General chemistry (++)

What volume of 0.100 M NaOH (aq) must be added to 100 ml of 0.2 M CH_3COOH to obtain a buffer solution with a pH of 4.50?

Given: pK_a (CH_3COOH) = 4.74

- a. $V = 54.8$ ml
- b. $V = 41.0$ ml
- c. $V = 82.0$ ml
- d. $V = 63.0$ ml
- e. $V = 73.0$ ml

Question 34

Not yet answered

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General chemistry (++)

What is the potential of the hydrogen electrode if it is immersed in pure water?

- a. $E = -0.41$ V
- b. $E = +0.41$ V
- c. $E = +0.82$ V
- d. $E = 0.00$ V
- e. Other value

Question 35

Not yet answered

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General chemistry (++)

In a 200 ml aqueous solution, the concentration of Ag^+ is found to be 10^{-5} M.

What quantity of HCl must be added to precipitate 99% of Ag^+?

Assume no volume change.

Given: the solubility product constant, $K_{sp} = 1.8 \times 10^{-10}$.

- a. n_{HCl} = 3.600 mmol
- b. n_{HCl} = 0.362 mmol
- c. n_{HCl} = 0.200 mmol
- d. n_{HCl} = 0.362 mmol
- e. n_{HCl} = 1.800 mmol

Question 36

Not yet answered

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General chemistry (+++)

What is the pH of an aqueous solution of 10^{-8} M HCl at 25°C?

- a. 7.00
- b. 8.00
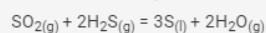- c. 6.98
- d. 6.57
- e. 10.00

Question 37

Not yet answered

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Chemical thermodynamics (+)

We consider the synthesis of sulfur according to the reaction:

$SO_{2(g)} + 2H_2S_{(g)} = 3S_{(l)} + 2H_2O_{(g)}$

Considering to the following data:

Product	$SO_{2(g)}$	$H_2O_{(g)}$	$H_2S_{(g)}$	$S_{(l)}$
$\Delta_f H°$ at 298 K (kJ mol^{-1})	−298.8	−241.8	−20.6	+11.8

What is the standard enthalpy of the reaction $\Delta_r H°$ at 298 K ?

- a. − 11.8 kJ mol^{-1}
- b. − 108,2 kJ mol^{-1}
- c. + 228.2 kJ mol^{-1}
- d. + 108,2 kJ mol^{-1}
- e. It cannot be calculated

Question 38

Not yet answered

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Chemical thermodynamics (+)

The partial molar volumes V_1 and V_2 of a mixture of 2 moles of water (M_1 = 18 g mol^{-1}) and 3 moles of ethanol (M_2 = 46 g mol^{-1}) are V_1 = 17.8 cm^3 mol^{-1} and V_2 = 55.5 cm^3 mol^{-1} respectively.

What is the total volume of the mixture?

- a. 0.202 L
- b. 164.4 mL
- c. 73.3 cm^3
- d. 202 dm^3
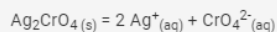- e. It cannot be calculated

Question 39

Not yet answered

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Chemical thermodynamics (++)

In the case of this endothermic dissolution process

$Ag_2CrO_4 {}_{(s)} = 2 Ag^+{}_{(aq)} + CrO_4^{2-}{}_{(aq)}$

which of these actions will shift the balance to the right?

- a. Pressure increase
- b. Addition of NaCl, which causes the precipitation of AgCl
- c. Addition of an excess of $Ag_2CrO_4 {}_{(s)}$
- d. Addition of $AgNO_3$, soluble in water
- e. Temperature decrease

Question 40
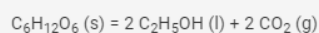
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Chemical thermodynamics (++)

The oxidation of glucose, $C_6H_{12}O_6$ in alcoholic fermentation leads to the formation of ethanol and carbon dioxide according to the reaction:

$$C_6H_{12}O_6 (s) = 2 C_2H_5OH (l) + 2 CO_2 (g)$$

For this equilibrium, the activity of CO_2 is written as $a(CO_2) =$

- a. 1
- b. $P(CO_2)/P°$ with $P(CO_2)$ is the partial pressure of CO_2 and $P°$ is the reference pressure (1 bar)
- c. $x(CO_2)$ with x the mole fraction
- d. $C(CO_2)$ with $C(CO_2)$ is the concentration of CO_2
- e. $P(CO_2)$ with $P(CO_2)$ is the partial pressure of CO_2
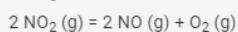

Question 41

Not yet answered

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Chemical thermodynamics (++)

Nitrogen monoxide and dioxide are in equilibrium according to:

$2 NO_2 (g) = 2 NO (g) + O_2 (g)$

This reaction is endothermic.

Predict the direction of the reaction if an inert gas is added at constant temperature and volume

- a. The system evolves in the direct direction (to the right)
- b. The system is in equilibrium and does not evolve
- c. There is not enough data to conclude
- d. The system can evolve in both directions
- e. The system evolves in the reverse direction (to the left)

Question 42

Not yet
answered

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Chemical thermodynamics (+++)

The hydrolysis of sucrose in an acid medium is not a rapid transformation. At constant temperature, in a buffer solution at pH = 5, the concentration of sucrose is measured as a function of time. The following results are obtained, with [S] denoting the sucrose concentration, [S°] its initial concentration and t the time in hours:

$\ln([S]/[S°]) = -0.0014\,t - 0.0069$

with $R^2 = 0.9998$

The order of the reaction is

- a. 2
- b. 1
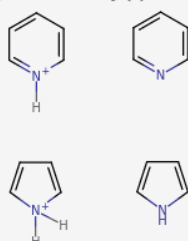- c. Unknown
- d. Multiple
- e. 0

Question 43

Not yet
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Organic chemistry (+)

First acido-basic couple is pyridinium / pyridine

Second acido-basic couple is pyrrolium / pyrrole

- a. In aromatics forms N is sp3 hybridised
- b. Aromaticity is a driving force who explain the acidity properties for one of this two acido-basic couple
- c. pyridinium is more acidic than pyrrolium
- d. only two of this 4 molecules are aromatics
- e. this 4 molecules are aromatics

Question 44

Not yet
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Organic chemistry (+)

Alkene reactivity

- a. C sp hybridised allows to form the alken group
- b. Carbon-carbon triple bond characterise alkene
- c. Br_2 addition on alkene is a *cis* addition
- d. Br_2 addition on alkene react via a bromonium intermediate
- e. Electrophilic addition to prochiral olefins can't be enantioselective
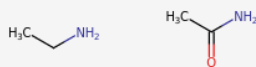
Question 45

Not yet answered

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Organic chemistry (++)

ethylamine   acetamide

- ○ a. There is a mesomeric form for acetamide witch is not zwitterionic
- ○ b. Amide bonds are not prevalent in biological molecules such as peptides, proteins, DNA, and RNA.
- ○ c. Amine react with carboxylic ac to give ammonium carboxylate salt
- ○ d. Acetamide is much more basic than ethylamine.
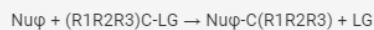- ○ e. Acid chlorides don't react with amines to form amides

Question 46

Not yet answered

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Organic chemistry (++)

Nuφ + (R1R2R3)C-LG → Nuφ-C(R1R2R3) + LG

Nuφ (nucleophilic reagent) ; LG (leaving group) ; R1 (alkyl group), R2 (alkyl group), R3 (alkyl group) with R1≠R2≠R3≠LG

- ○ a. In case of an SN1 mechanism the reaction is a stereosective reaction
- ○ b. A good leaving group is a good nucleophilic reagent
- ○ c. A good nucleophilic reagent have to be a strong base
- ○ d. For SN1 mechanism, the rate of substitution reactions depends on the concentration of the nucleophilc reagent
- ○ e. In case of an SN2 mechanism the substitution **occurs with inversion of configuration**
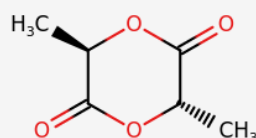
Question 47

Not yet answered

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Organic chemistry (+++)

Lactid is a cyclic dimer of lactic ac.

- ○ a. Lacid is achiral and have 2 asymmetric centers
- ○ b. This Lactid have 3 other diastereoismers
- ○ c. The two stereodescrptors are R and R
- ○ d. This lactid have an enantiomer (with which it is nonsuperposable)
- ○ e. Lacid is chiral and have 2 asymmetric centers