

Coaching Report

Participant	Student Ljubljanski	Student detail	User_52
Group	ntc.at ats.at	Status	Ended normally
Assessment name	Physical Chemistry 3 - EN V4	Final Score	32
Time Used	00:09:41	Time limit (min)	10
Date taken	15-09-2016 18:25:52		

Questions - presented: 30, answered: 30

- 1** The small table below lists the pressure and temperature of some substances kept in commercial cylinders. Using this information and the second table, indicate the state of oxygen in the cylinder.



Question type	Multiple Choice
Topic	State of Matter
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	Gas state
Answer	<p>0) Solid state</p> <p>1) Liquid state</p> <p>2) Supercritical fluid</p>

3) Gas state

4) Gas-liquid equilibrium

2 Calculate the number of degrees of freedom from the phase rule for a mixture of liquid benzene, benzene vapour and helium gas.



Question type	Multiple Choice
Topic	Phase Equilibria
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	2
Answer	0) 0 1) 1 2) 2 3) 3

3 Consider the following atomic orbitals for the hydrogen atom. Which orbital has the highest energy ?



Question type	Multiple Choice
Topic	Atomic Structure
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	1s
Answer	0) 1s 1) 2s

- 2) $2p_x$
- 3) $3p_y$
- 4) $3d_{z^2}$
- 5) $4s$

4 Suppose you have to neutralize one liter of a 0.1 molar solution of acetic acid (a weak acid having only 1.3% of its molecules dissociated in this solution), how much sodium hydroxide will you need ?



Question type	Multiple Choice
Topic	Chemical Equilibria
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	0.1 mol
Answer	0) Less than 0.1 mol 1) 0.1 mol 2) More than 0.1 mol

5 During an experiment the rate of the following reaction was measured $2A + 3B \rightarrow C + 3D$ and the following results were obtained: [A]₀ [B]₀ initial rate
 0.32 mol/L 0.42 mol/L 1.56 mol 0.32 mol/L 0.21 mol/L 0.39 mol 0.25 mol/L 0.21 mol/L 0.39 mol Which of the following statements is correct ?



Question type	Multiple Choice
Topic	Kinetics
Difficulty	1/3

Score	3.30
Score max	1
Answer choosen	The reaction has order 2 with respect to B
Answer	<p>0) The total reaction order is 5</p> <p>1) The reaction has order 2 with respect to B</p> <p>2) The reaction has order 1 with respect to A</p> <p>3) The reaction has order 1 with respect to B-1</p>

6 1 mol of an ideal gas expands isothermally and reversibly at 298 K from $p_1 = 106 \text{ Pa}$ to $p_2 = 105 \text{ Pa}$. What is the change in entropy of the system plus the surroundings in JK-1 ? JK-1



Question type	Numeric
Text	
Topic	Thermodynamics
Difficulty	1/3
Score	0.0
Score max	1
Answer choosen	a CH ₂ =CH- group
Answer	0) 0.0

7 Given that $dU = TdS - pdV + m dn$ (for an open system of a single component) $A = U - TS$ and $G = U + pV - TS$ which three of the following Maxwell type expressions are thermodynamically correct ?



Question type	Multiple Response
Topic	Thermodynamics

Difficulty	1/3
Score	0.99
Score max	1
Answer choosen	$(dm / dV)_{T,n} = - (dp / dn)_{V,T}$
Answer	<p>0) $(dT / dV)_{S,n} = - (dp / dS)_{V,n}$</p> <p>1) $(dV / dn)_{p,T} = - (dm / dp)_{T,n}$</p> <p>2) $(dm / dV)_{T,n} = - (dp / dn)_{V,T}$</p> <p>3) $(dS / dV)_{p,n} = (dT / dp)_{V,n}$</p> <p>4) $(dV / dT)_{p,n} = (dS / dp)_{T,n}$</p>

8 The classical transition state theory assumes that when the system reaches the transition state



Question type	Multiple Choice
Topic	Catalysis
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	it can only go ahead
Answer	<p>0) it can only go back</p> <p>1) it can stay there for ever</p> <p>2) it can only go ahead</p> <p>3) it can recross back</p> <p>4) it can tunnel</p>

9 The kinetics of enzyme action are described by the Michaelis-Menten mechanism. Some substances may interact with the enzyme reducing its catalytic activity. They are called inhibitors. Which of the following sentences

describe best the inhibition process ?



Question type	Multiple Choice
Topic	Catalysis
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	In non-competitive inhibition, the catalytic activity is reduced because the inhibitor reduces the speed of reaction
Answer	<p>0) In non-competitive inhibition, an inhibitor attaches to a remote site of the enzyme and causes a structural change that bars the substrate from the active site</p> <p>1) In non-competitive inhibition, the substrate and the inhibitor attach the enzyme to two different active sites</p> <p>2) In non-competitive inhibition, the inhibitor attaches to the substrate but not to the enzyme</p> <p>3) In non-competitive inhibition, the catalytic activity is reduced because the inhibitor reduces the speed of reaction</p>

10

The equilibrium constant of the reaction which takes place in a Daniell cell

$\text{Zn} \mid \text{Zn}^{2+} \parallel \text{Cu}^{2+} \mid \text{Cu}$

is:



Question type	Multiple Choice
Topic	Electrochemistry
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	4.641036
Answer	0) 4.641036 1) 6.021023 2) 4.6410-36 3) 4.61017 4) 5.6710-12

11 The solubility of $\text{Mg}(\text{OH})_2$ is $7 \cdot 10^{-2} \text{ mol L}^{-1}$ Data: $K_{\text{sp}}(\text{Mg}(\text{OH})_2) = 1.8 \cdot 10^{-11}$



Question type	Multiple Choice
Topic	Electrochemistry
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	at pH = 13
Answer	0) at pH = 9 1) at pH = 3 2) at pH = 5 3) at pH = 7 4) at pH = 13

12 How many and which kind of degrees of freedom do we find in the N_2O



Question type	Multiple Choice
Topic	Molecular Structure
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	3 translational + 3 rotational + 4 vibrational
Answer	0) 3 translational + 2 rotational + 4 vibrational 1) 3 translational + 3 rotational + 3 vibrational 2) 3 translational + 2 rotational + 3 vibrational 3) 3 translational + 3 rotational + 4 vibrational

13 The interaction between two H₂O molecules is stronger than that between two CO₂ molecules. Which of the following is the best explanation ?



Question type	Multiple Choice
Topic	Molecular Structure
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	The dipole moment of H ₂ O is bigger than that of CO ₂
Answer	0) The dipole moment of H ₂ O is bigger than that of CO ₂ 1) H ₂ O is a bent molecule but CO ₂ is linear 2) H is less electronegative than C

3) H₂O contains H but CO₂ does not

14 The nuclear spin of both ³¹P and ¹⁹F is $I = 1/2$. Which two of the following statements are true concerning the NMR spectra of PF₃ which has C_{3v} symmetry ?



Question type	Multiple Response
Topic	Spectroscopy
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	The ¹⁹ F spectrum is a singlet
Answer	<div>0) The ³¹P spectrum is a singlet</div> <div>1) The ³¹P spectrum is a doublet</div> <div>2) The ³¹P spectrum is a quartet</div> <div>3) The ¹⁹F spectrum is a singlet</div> <div>4) The ¹⁹F spectrum is a doublet</div> <div>5) The ¹⁹F spectrum is a quartet</div>

15 In which part of the spectrum is the Balmer series of lines observed ?



Question type	Multiple Choice
Topic	Spectroscopy
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	Ultraviolet
Answer	<div>0) Visible</div>

- 1) Infrared
- 2) Far infrared
- 3) Ultraviolet

16 A 'rule of thumb' says that a temperature increase from 20°C to 30°C leads to a doubling of many reaction rates. Calculate the activation energy in kJ/mol for which the 'rule of thumb' would be exact. Data: $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$

kJ/mol



Question type	Numeric
Text	
Topic	Kinetics
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	tempera
Answer	0) 51.16

17 Given the reaction $aA + bB \rightarrow pP + qQ$ to define v_A as $(-1/a)d[A]/dt$, with $[A]$ being the concentration of A, one can assume that...



Question type	Multiple Choice
Topic	Kinetics
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	the amount of substance is constant
Answer	0) temperature is constant

- 1) volume is constant
- 2) pressure is constant
- 3) energy is constant
- 4) the amount of substance is constant

18

Consider the reduction of permanganate by oxalic acid at 298 K



If the two half-reactions and the corresponding standard electrode potentials are



what is the equilibrium constant of the reduction of permanganate by oxalic acid?

Data: $R = 8.3144 \text{ JK}^{-1}\text{mol}^{-1}$, $F = 96484 \text{ Cmol}^{-1}$



Question type	Multiple Choice
Topic	Electrochemistry
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	103.39
Answer	<p>0) 10339</p> <p>1) 1033.9</p> <p>2) 103.39</p> <p>3) 10-33.9</p> <p>4) 10-3.39</p>

19

Methylamine (CH_3NH_2) decomposes thermally on Pt surfaces to HCN and H_2 .

This dehydrogenation reaction is believed to occur via a series of steps involving successive removal of H as temperature is increased from room temperature. In a study of the decomposition of methyliamine-d₃(CD₃NH₂), H₂, HD and D₂ are evolved successively at 410, 425 and 435 K respectively, in a 1:2:1 ratio. There is NO isotopic scrambling between these species. Which two of the following are compatible intermediates in the dehydrogenation of methylamine ?



Question type	Multiple Response
Topic	Catalysis
Difficulty	2/3
Score	1.65
Score max	1
Answer choosen	CH ₂ N
Answer	0) CH ₂ NH 1) CH ₂ NH ₂ 2) CH ₃ N 3) CH ₃ NH 4) CH ₂ N

20 Consider the molecular energy-level diagrams for the diatomic molecules C₂ and O₂ in their respective ground states. For which molecule(s) will the bond in the cation X₂⁺ be weaker than that in the neutral molecule X₂ ?



Question type	Multiple Choice
Topic	Molecular Structure
Difficulty	2/3

Score	0.00
Score max	1
Answer choosen	None
Answer	0) C2 1) O2 2) None 3) Both C2 and O2

21 The molar absorptivity of chlorobenzene in n-heptane solution at 256 nm is = $1.22103 \text{ m}^2 \text{ mol}^{-1}$. Calculate the concentration of chlorobenzene in a n-heptane solution if its transmission coefficient at 256 nm in a 2 cm cell is $0.296 \cdot 10^{-5}$



Question type	Numeric
Text	
Topic	Spectroscopy
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	acrylics
Answer	0) 2.17

22 Consider an ideal solution formed by 3.00 mol of benzene and 2.00 mol of toluene. Calculate the ratio between the fugacity of pure benzene and the fugacity of benzene in the ideal solution. Consider all quantities at constant temperature and pressure.



Question type	Multiple Choice
Topic	Thermodynamics

Difficulty	2/3
Score	3.30
Score max	1
Answer choosen	1.67
Answer	0) 0.60 1) 1.67 2) 0.40 3) 2.50 4) 1.00

23 Consider two atoms A and B, both from the second period (Li-Ne). If A is substantially more electronegative than B, which two of the following statements are correct ?



Question type	Multiple Response
Topic	Atomic Structure
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	The atomic radius is larger for A than for B The atomic number is higher for A than for B
Answer	0) The atomic radius is larger for A than for B 1) The atomic number is higher for A than for B 2) The first ionization energy (or ionization potential) is higher for A than for B 3) The effective nuclear charge, Z_{eff} or Z^* , is

lower for A than for B

24 The ionization energy (or ionization potential) of H is 13.6 eV. What is the second ionization energy of He ?eV



Question type	Text
Topic	Atomic Structure
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	acrylics
Answer	0) 54.4 1) 54.4 2) 54.40 3) 54.40 4) 54.400 5) 54.400 6) 54

25 N molecules of an ideal gas are restricted to move within the two-dimensional area S. If d is the collision diameter of these molecules and the relative speed of the colliding molecules is equal to the mean speed multiplied by $2^{1/2}$, then the mean free path is given by



Question type	Multiple Choice
Topic	State of Matter
Difficulty	2/3
Score	0.00

Score max	1
Answer choosen	S / (21/2 Nd)
Answer	0) S / (23/2 Nd)
	1) S / (23/2 Nd)
	2) S / (23/2 Nd ²)
	3) S / (21/2 Nd ²)
	4) S / (21/2 Nd)

26 When a gas obeys the Berthelot equation of state $P = RT / (V_m - b) - a / TV_m^2$ where a, b are constants, then its critical molar volume, $V_{m,c}$, is equal to



Question type	Multiple Choice
Topic	State of Matter
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	b/3
Answer	0) 3b
	1) 2b
	2) b
	3) b/2
	4) b/3

27 Consider the dissociation of $H_2(g)$ to hydrogen atoms at a certain high temperature. The degree of dissociation depends upon the total pressure P. Which of the following plots is linear ?



Question type	Multiple Choice
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Topic	Chemical Equilibria
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	(1 -) / P vs.
Answer	0) (1 -) / P vs. 1) 1 / P vs. 2) (1 - 2) / P vs. 2 3) 1 / P vs. 2 4) (1 -) / P vs. 2

28 If HCl(aq) is treated as a strong electrolyte, what can be said about rG and the equilibrium constant for the reaction: $\text{HCl(aq)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$



Question type	Multiple Choice
Topic	Chemical Equilibria
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	$rG = 0$ and $K = 1$ at any temperature
Answer	0) $rG = 0$ and $K = 1$ at any temperature 1) $rG = 0$ and $K = 1$ at 1 bar and K is undefined 2) K is undefined 3) There is not enough information 4) $rG = 0$ and $K = 1$ at 1 bar and any temperature

29 A mixture of the immiscible liquids bromobenzene (BB) and water boils, at 1 atm and 368 K, where the vapour pressure of water is 635 Torr. What is the ratio x_{BB} / x_{water} of the mole fractions of the two components in the vapour at the same temperature if the vapour behaves like a mixture of two ideal gases ? $x_{BB} / x_{water} =$



Question type	Numeric
Text	
Topic	Phase Equilibria
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	not ok
Answer	0) 0.197

30 Which of the following magnitudes are null in a phase transition of second order or higher ?



Question type	Multiple Choice
Topic	Phase Equilibria
Difficulty	2/3
Score	3.30
Score max	1
Answer choosen	trsH = 0; trsS = 0; trsV = 0 and trsG = 0
Answer	<p>0) trsH = 0; trsS = 0; trsV = 0 and trsG = 0</p> <p>1) trsCv = 0; trsS = 0; trsV = 0 and trsG = 0</p> <p>2) trsCp = 0; trsS = 0; trsV = 0 and trsG = 0</p>

3) only $\text{trsV} = 0$ and $\text{trsH} = 0$

4) $\text{trsCp} = 0$; $\text{trsS} = 0$; $\text{trsH} = 0$ and $\text{trsG} = 0$