

SERANGOON JUNIOR COLLEGE General Certificate of Education Advanced Level Higher 1

CHEMISTRY JC2 Preliminary Examination Paper 1 Multiple Choice

8873/01 20 September 2018 1 hour

1	В	6	В	11	А	16	С	21	А	26	D
2	В	7	А	12	В	17	В	22	А	27	С
3	D	8	А	13	D	18	В	23	D	28	А
4	С	9	С	14	D	19	В	24	А	29	D
5	D	10	А	15	В	20	С	25	В	30	А

WORKED SOLUTIONS

1	Us	Jse of the <i>Data Booklet</i> is relevant to this question.							
	What is the number of atoms in 800 cm ³ of hydrogen gas under room temperature conditions?								
	Α	A 2.0 x 10 ²²							
	В	4.0 x 10 ²²							
	С	2.0 x 10 ²⁵							
	D	4.0 x 10 ²⁵							
	Ans: B								
	$n_{\text{H}} = \frac{0.8}{24} \times 2$ number of H atoms = $\frac{0.8}{24} \times 2 \times 6.02 \times 10^{23} = 4.0 \times 10^{22}$								

2	Use of the Data Booklet is relevant to this question.										
	The relative abundances of the isotopes of a sample of carbon are shown in the table below.										
	relative isotopic mass 12 13 14										
	relative abundance					100	1.08	(0.01		
	What is the relative atomic mass of carbon in this sample?										
	A 12.00 B 12.01 C 12.10 D 12.15										
	Ans: B										
	Relative atomic mass = $\frac{(12 \times 100) + (13 \times 1.08) + (14 \times 0.01)}{100 + 1.08 + 0.01}$ = 12.01										

	substance	substance melting point/ °C		boiling		electrical conductivity			
	Substance		C	point	/ °C		of solid	of liquid	
	E	17	45		5		Poor	Poor	
	F	64		75	9		Good	Good	
	G	1132		195	50		Poor	Good	
	н	3550		382	25		Good	Unknown	
١	What could be	e the identities o	of E, F	F, G and	H ?		G	ц	
	A			F		Na ₂ O			
	R		003 N/O		K		Na-0		
	C	SO_3		PCl₅ K		C (graphite) Na ₂ O		Na ₂ O C (graphite)	
	D	SO ₃							
1	Ans: D								
	substance	ubstance melting b		oiling nt/ °C	elec of s	ctrical conductivity solid of liquid		Structure	
	Е	17		45	Po	or	Poor	SMS PC <i>l</i> 5 / SO3	
	F	64	7	759	Go	od	Good	GMLS K	
	G	1132	1	950	Po	or	Good	GILS Na ₂ O	
	н	3550	3	3825 G		ood Unknown		GMS Graphite	
	Craphite Craphite								

4	10 cm ³ of hydrogen peroxide was diluted to 250 cm ³ using a standard flask. 25.0 cm ³ of the diluted solution was reacted with 10 cm ³ of concentrated potassium iodide in the							
	presence of dilute sulfuric acid. The resulting mixture was then titrated with							
	0.10 mol dm ⁻³ sodium thiosulfate. It was found that 21.00 cm ³ of thiosulfate was required							
	to reach end-point.							
	The following shows the reactions described above.							
	$H_2O_2 + 2I^- + 2H^+ \rightarrow I_2 + 2H_2O$							
	$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$							
	what is the initial concentration of the hydrogen peroxide used?							
	A 0.04 mol dm ⁻³							
	B 0.08 mol dm ⁻³							
	C 1.05 mol dm ⁻³							
	D 2.10 mol dm ⁻³							
	Ans: C							
	Mole ratio $2S_2O_3^2$: 1 I ₂ : 1H ₂ O ₂							
	$n S_2 O_2^{2-} = \frac{21.00}{2} \times 0.10 = 2.10 \times 10^{-3} mol$							
	$n H_2 O_{2in} = \frac{1}{1000} \times 0.10 = 2.10 \times 10^{-3}$ mol							
	$n H_2O_2 in 250 cm^3 = 1.05 \times 10^{-2} mol$							
	initial concentration of $H_2O_2 = 1.05 \times 10^{-2} / (10/1000) = 1.05 \text{ mol dm}^{-3}$							

5	Wł	Which of the following is a redox reaction?						
	Α	A NaOH + HBr → NaBr + H₂O						
	В	$FeCl_3 + 6H_2O \rightarrow [Fe(H_2O)_6]^{3+} + 3Cl^-$						
	С	$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2 H_2O$						
	D	$Cu + NH_3 + O_2 + H_2O \rightarrow [Cu(NH_3)_4](OH)_2$						
	Ans: D There are no change in oxidation numbers of any species for options A, B and D. Option C: Cu is oxidised from 0 to +2 O is reduced from 0 to -2							

6 Which of the following statements is untrue about the second ionisation energies of Period 2 elements?
A The general trend is similar to that of first ionisation energies.
B Increase in shielding effect outweighs the increase in nuclear charge.
C The anomalies lie between group 13 and 14, and between 16 and 17 elements.
D There is increasing electrostatic forces of attraction between the nucleus and valance electrons.
Ans: B
Across the period, shielding effect is similar as electrons are added to the same quantum shell. Thus, B is untrue.

7	When ₄He nuclei was pass through an electric field, it was deflected 4°.							
	Which of the following ions would be deflected half as much as the ₄ He nuclei in the opposite direction?							
	Α	C ³⁻						
	В	N ³⁻						
	С	Na ⁺						
	D	Mg ²⁺						
	An	is: A						
	Concept: $\frac{e}{m} \alpha$ angle of deflection							
	$\frac{e}{m}$ of ₄ He nuclei is + ¹ / ₂ (You need to know that the nucleus is positively charged)							
	Thus, only options A and B are possible, as they will deflect in the opposite direction. $\frac{e}{m}$ of C ³ -is - ¹ / ₄							
	He	ence, will be deflected half as much as the ₄He nuclei in the opposite direction.						

8	Which of the following statements is true for Al^{3+} ?							
	Α	A There are no d orbitals occupied.						
	В	B There are a total of five subshells occupied.						
	С	C There are a total of three s orbitals occupied.						
	D The last electron removed to obtain Al^{3+} came from the 3p orbital.							
	 Ans: A Al³⁺: 1s²2s²2p⁶ No d orbitals is occupied. There are 3 subshells occupied. There are two s orbitals occupied. The first 3 electrons removed obtain Al³⁺ came from the the 3p orbital first followed by 3s orbital. 							

Bot P₄(Wh	th of the resulting solution O_{10} .	tions could dis	solve Al ₂ O ₂ b								
Wh			oth of the resulting solutions could dissolve Al_2O_3 but only one of the two could dissolve P_4O_{10} .								
	hich of the following pa	airs could be the	ne chloride ar	nd the oxide u	ised?						
1	NaC <i>l</i> SC	\mathbf{D}_3									
2	MgCl ₂ Mg	gO									
3	SiCl ₄ Na	a ₂ O									
Α	2 only										
В	1 and 3										
С	2 and 3										
D	1, 2 and 3										
An	s: C		1								
You	u should work these out	first:									
101		Compound	На	Compound	Ha						
	In announ	NaCl	7 (neutral)	SO ₃	3 (acidic)						
	solution	MgCl ₂	6.5 (slightly acidic)	MgO	12 (basic)						
SiCl ₄ 2			2 (acidic)	Na ₂ O	13 (basic)						
Since both of the resulting solutions can be used to dissolve A_2O_3 (amphoteric) but only one of the two can be used to dissolve P_4O_{10} , one of the solution has to be acidic											



11	Which one of the following cannot be explained using hydrogen bonding?							
	Α	A CH ₃ CHO has a higher boiling point than C_2H_6 .						
	В	3 CH ₃ COOH has a M _r of 120 in benzene.						
	С	C HF has a higher boiling point than HC <i>l</i> .						
	D	CH_3COCH_3 is miscible with water.						
	Ans: A Intermolecular H-bonds form btw molecules with N, O or F atoms directly bonded to H atom.							
	Aldehyde groups such as CH₃CHO do not have intermolecular H-bonds.							
	CH ₃ CHO has intermolecular pd-pd forces of attraction , while C ₂ H ₆ has intermolecular id-id forces of attraction. H-bond does not account for this difference.							





14	Which of these mixtures will form a buffer solution?								
	Α	a 20 cm ³ sodium hydroxide and 10 cm ³ sulfuric acid of the same concentration							
	В	Equal volumes of 1.0 mol dm ⁻³ sodium hydroxide and 2.0 mol dm ⁻³ ammonia							
	С	C Equal volumes of 1.0 mol dm ⁻³ ethanoic acid and 1.0 mol dm ⁻³ ammonia							
	D	10 cm ³ ethanoic acid and 20 cm ³ sodium ethanoate of the same concentration							
	 Ans: D Buffer solution consists of weak acid and salt of its conjugate base. Option A is wrong – NaOH is strong base, H₂SO₄ is strong acid. Option B is wrong – NaOH is strong base, NH₃ is weak base. No rxn as well. Option C is wrong – both CH₃COOH and NH₃ in the context will completely neutralise to form salt and water. Option D consist of weak acid and salt of its conjugate base – acidic buffer. 								

15	Given the following data, determine the enthalpy of hydrogenation of ethene, $CH_2=CH_2$ to ethane, CH_3CH_3 .								
			compound	enthalpy change of combustion $\Delta H_c{}^{\theta}$					
			$CH_2=CH_2$ (g)	-1411					
			H ₂ (g)	-286					
			CH ₃ CH ₃ (g) –1560						
				$\Delta H^{\Theta}_{hvdrogenation}$					
	$CH_2=CH_2 (g) + H_2 (g) \longrightarrow CH_3CH_3 (g)$								
	Α	A +137 kJ mol ⁻¹							
	B –137 kJ mol ^{−1}								
	C +1084 kJ mol ⁻¹								
	D –1084 kJ mol ⁻¹								
	Ans: B								
	$\Delta H^{\theta}_{hydrogenation} = \sum \Delta H^{\theta}_{c} (rxt) - \sum \Delta H^{\theta}_{c} (pdt) = (-1411 - 286) - (-1560) = -137 kJ mol^{-1}$								

16	Which of these statements account for the lower melting point of aluminium oxide as compared to magnesium oxide?	
	Α	Aluminium oxide is a simple molecular structure.
	В	Aluminium oxide has weaker intermolecular forces of attraction.
	С	Aluminium oxide has a greater covalent character than magnesium oxide.
	D	Aluminium oxide has a larger magnitude of lattice energy than magnesium oxide.
	An Ca Ai bo	is: C and D are wrong as aluminium oxide is a giant ionic compound. s wrong as a larger magnitude of lattice energy is proportional to strength of ionic nd.

17	Which statement best explains the reason why the reaction between 10 cm ³ of 0.1 mol dm ⁻³ sodium hydroxide with 5 cm ³ of oxalic acid 0.1 mol dm ⁻³ is more exothermic than between sodium hydroxide with hydrochloric acid of the same			
	res	respective volumes and concentrations?		
	HO O OH			
		Oxalic acid		
•	Α	Some energy is required to further dissociate the weak acid.		
	В	More molecules of water are produced in the first reaction.		
	С	Both acids are limiting reagents.		
	D	Heat loss to the surrondings.		
	An	is: B		
	A is wrong as the question stated that the weak acid reaction is more exo than the strong acid reaction.			
	B dis	is right as the amount of base is the same for both reactions but oxalic acid sociates two H ⁺ per mol hence more H ⁺ has been neutralised.		
	C i	s wrong as oxalic acid is not a limiting reagent.		
	D i ha	s wrong as both reactions would have heat lost to surroundings and it should not ve an impact as to why oxalic acid reaction is more exo.		

18	Th sys	e diagram shows the structure of a catalytic converter as fitted into the exhaust stem of a car. It also describes the substances involved in the exhaust gases.
	gases going in: carbon monoxide, hydrocarbons and oxides of nitrogen Which processes take place in the catalytic converter?	
	1	Platinum and cohalt catalyse redox reactions
	י 2	Carbon monoxide and oxides of nitrogen react together
	-	Carbon monoxide and hydrocarbons react together.
	4	Hydrocarbons and oxides of nitrogen react together.
	Α	1 and 2
	В	2 and 3
	С	2 and 4
	D	1 and 3
	An	s: B
	Ca	talytic converters use <u>3 types of catalysts</u> : Pt, Pd, Rh, not Co .
	<u>2 r</u> NC	nain reactions take place:) is reduced to N_2 by the excess CO present.
	2N	O (g) + 2CO (g) → 2CO ₂ (g) + N ₂ (g)
	Un wit	burnt hydrocarbons are oxidized to CO_2 and H_2O while CO is oxidized to CO_2 , h Pt as the catalyst.
	C _x	$H_y(g) + (x + y/4)O_2(g) \rightarrow xCO_2(g) + y/2 H_2O(g)$
	2C	$O(g) + O_2(g) \rightarrow 2CO_2(g)$



1	_			
20	A	A piece of bone from an archaeological dig was found to contain 6.25 x 10 ⁻⁴ mol of		
	C^{14} atoms. Given that the estimated original amount of C^{14} in that piece was supposed			
	to	a contract matching bounded this piece of bong in		
	10	be 0.01 mol, calculate now old this piece of bone is.		
	(ha	alf-life of $C^{14} = 5730$ years)		
	Α	A 16 years		
	В	8267 years		
	S	22 920 years		
	D	91 680 years		
	Ans: C			
	Method 1			
	6.2	25×10^{-4} /0.01 = (1/2) ⁿ , where n = no, of half-lives elapsed		
	n =	- 4		
	Method 2			
	0.0	01→0.005→0.0025→0.00125→0.000625 (4 half-lives have passed)		
	Thus, time elapsed = 4 x 5730 = 22920 years			

21	Δt	At 35°C K = 1.6 x 10 ⁻⁵ mol dm ⁻³ for the following reaction		
21	Л	At 35 C, $N_c = 1.0 \times 10^{-1101}$ that the following reaction		
		$2 \operatorname{NOC} l(g) \rightleftharpoons 2 \operatorname{NO} (g) + C l_2(g) \Delta H > 0$		
	Wł	nich one of the following statements is correct?		
	Α	[NO] < [NOC <i>l</i>] at equilibrium		
	В	$K_{\rm c}$ will decreases when temperature increases.		
	С	Addition of catalyst will cause more Cl_2 to be formed.		
	D	Position of equilibrium will shift to the right when total pressure of the system increases.		
	Ans: A			
	 K_c = [products] [reactants] Since K_c <1, equilibrium position lies to the left, signifying [reactants] > [products]. Thus, A is true. B, C and D are incorrect: When temperature increases, eqm position shifts to the right, forming more produc Thus, K_c should increase. Addition of catalyst does not affect yield. 			
	When pressure increases, eqm position shifts to the left, to form fewer number of mol of gas.			



23	Which of the following compounds on reaction will produce ethanoic acid?	
	1	CH ₃ CH=CH ₂ and steam
	2	CH ₃ COOCH ₃ and dilute HC <i>l</i> , reflux
	3	CH ₃ CH ₂ CHO and acidified KMnO ₄ , reflux
	4	CH ₃ CH ₂ OH and acidified K ₂ Cr ₂ O ₇ , reflux
	Α	1 and 2
	В	2 and 3
	С	3 and 4
	D	2 and 4
	An	s: D
	Option 1 produces CH ₃ CH ₂ CHOH Option 2: Hot acid causes –COO ester linkage to be hydrolysed, forming <u>CH₃COOH</u> Option 3: Oxidation of aldehyde, propanal, CH ₃ CH ₂ CHO, forms propanoic acid instead Option 4: Oxidation of primary alcohol, ethanol, forms <u>CH₃COOH</u>	

24	Lir the	alyl acetate is a naturally-occurring compound and it is a principal component of essential oils of lavender. $(CH_3)_2C=CHCH_2CH_2-C-CH=CH_2$ $O-C-CH_3$ O
		Linalyl acetate
	Wł	nich one of the statements is not true about linalyl acetate?
	Α	It is a condensation polymer.
	В	It cannot exhibit cis-trans isomerism.
	С	It reacts with hot sulfuric acid.
	D	It reacts with 2 mol of hydrogen gas.
	Ans: A	
	Option A is not true . This is not a polymer, as there are no repeat units / polyester linkages present.	
	 Option B is true. No cis-trans isomerism in the compound as both C=C has same type of substituents attached to one of the C atoms. Option C is true, as the ester linkage will be hydrolysed in the presense of hot NaOH. Options D is true, as 2 mole of C=C is present, thus 2 mol H₂ is needed for hydrogenation. 	





27	Which of these statements is incorrect for a sheet of graphene?		
	Α	It is able to conduct electricity.	
	В	It has a giant molecular structure.	
	С	It is a nanoparticle.	
	D	It is a planar molecule.	
	Ans: C		
	The best answer is C as no details about the dimension is given, hence we do no know if it is a nanoparticle or nanomaterial.		

28	Which of these statements are correct?			
	Α	Nanomaterials have one of its dimensions within 10 nm to 100 nm.		
	В	Lizards are able to climb on wet surfaces due to hydrogen bonding		
	_			
	C	The vivid pink colour of flamingo feathers are due to papostructures		
	v	The wind plane colour of harmingo reducers are due to harboardetares.		
	D	Picoscopic (10^{-12}) volcanic dust pose no threat when inhaled		
	An	s· A		
	<i>.</i>			
	Pic	coscopic (10 ⁻¹²) volcanic dust is a nanoparticle and can cause damage to our		
	Internal organs when innaled.			

29	Which of these statements are inconsistent with the properties of a polyamide shirt?		
	Α	It is able to absorb water well.	
	В	It is prone to creasing.	
	С	It is a condensation polymer.	
	D	It is resistant to basic hydrolysis.	
	Ans: D		
	Polyamides are prone to hydrolysis.		



END