CHEMISTRY UNIT 1 2016

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Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	16	16	32	/32	/20
Section Two: Short answer	7	7	35	/40	/30
Section Three: Extended answer	7	7	60	/62	/50
				/134	/100

- 1. What is the total number atoms in the formula $Ca_3(PO_4)_2$?
 - (a) 3
 - (b) 12
 - (c) 13
 - (d) 14
- 3. What is the correct sequence for obtaining salt from a mixture of salt and sand?
 - (a) Evaporation, dissolve in water, filtration.
 - (b) Dissolve in water, evaporation, filtration
 - (c) Dissolve in water, filtration, evaporation.
 - (d) Filtration, evaporation, dissolve in water.
- 4. Which of the following has been incorrectly balanced?
 - (a) $Fe_3O_4 + 3H_2 \rightarrow 3Fe + 3H_2O$
 - (b) Mg + 2HCl \rightarrow MgCl₂ + H₂
 - (c) $2AgNO_3 + CaCO_3 \rightarrow Ca(NO_3)_2 + Ag_2CO_3$
 - (d) $CuCO_3 \rightarrow CuO + CO_2$

- 6. Which of the following correctly states the trend for first ionisation energy on the periodic table?
 - (a) It increases as you move across a period and down a group.
 - (b) It increases as you move across a period and decreases down a group.
 - (c) It decreases as you move across a period and down a group.
 - (d) It decreases as you move across a period and increases down a group.
- 7. Select which of the following is not a property of metals:
 - (a) They are lustrous.
 - (b) They have high boiling points.
 - (c) They are reasonably chemically inactive.
 - (d) Most are solid a room temperature.
- 8. Three groups of chemistry students were asked to weigh a standard paperclip with a weight of 0.45g, three times and obtain an average.

Groups	Ma	Average		
1	0.44	0.45	0.44	0.44
2	0.48	0.51	0.50	0.49
3	0.45	0.44	0.46	0.45

Analyse the information and determine (if any) of the groups contain systematic errors.

- (a) 1
- (b) 2
- (c) 1 and 3
- (d) None of the three groups contain systematic errors.
- 9. Select which element has the lowest electronegativity.
 - (a) N
 - (b) Li
 - (c) K
 - (d) S
- 10. The percentage by mass of water found in Copper (II) sulfate pentahydrate is
 - (a) 7.2 %
 - (b) 57 %
 - (c) 83 %
 - (d) 36 %

- 12. Which of the following correctly states the trends in atomic radii?
 - (a) As you move across a period the atomic radii increases, and down a group it also increases.
 - (b) As you move across a period the atomic radii increases, and down a group it decreases.
 - (c) As you move across a period the atomic radii decreases, and down a group it also decreases.
 - (d) As you move across a period the atomic radii decreases, and down a group it increases.
- 13. As the following reaction takes place, the observations that would be seen are;

 H_2SO_4 + $CuCO_3$ \rightarrow $CuSO_4$ + H_2O + CO_2

- I. Green solid dissolves
- II. Colourless gas formed
- III. White solution forms
- IV. Blue solution formed
- V. Green solid forms
- (a) I, II and III
- (b) I, II, III and V
- (c) I, II and IV
- (d) II, V and IV
- 14. Select the most appropriate explanation why an ionic substance can conduct electricity in aqueous solution but not in the solid form.
 - (a) In the solid form, the negative ions are fixed within a 3D crystallised lattice that required a large amount of energy to overcome.
 - (b) In the solid form, the positive ions and delocalised electrons are in a fixed 3D lattice and cannot move.
 - (c) In the aqueous solution, the delocalised electrons are no longer in a fixed 3D lattice and are free to move and conduct electricity.
 - (d) In the aqueous solution, the positive and negative ions are no longer in a fixed 3D lattice and are free to move and conduct electricity.

- 15. Which of the following is FALSE about valence electrons?
 - (a) Elements in the same group of the periodic table have the same number of valence electrons.
 - (b) Valence electrons are transferred or shared when chemicals react together.
 - (c) As you move across the period 3, from left to right, the number of valence electrons increases and then decreases.
 - (d) As you move across the period 3, from left to right, the number of valence electrons increases.
- 16. Which of the following formulae represents a molecule of a compound?
 - (a) S₈
 - (b) NO₂
 - (c) MgCl₂
 - (d) Si
- 17. Which of the following would contain discrete molecules?
 - (a) Bromine gas.
 - (b) Sodium chloride.
 - (c) Graphite.
 - (d) Copper.

Analyse the information below about the conductivity of three different substances to answer question 18 and 19.

		Conduct electricity	1
Substance	Solid	Molten	Aqueous
Α	X	Х	X
В	X	✓	✓
С	✓	✓	✓

- 18. From this information it can be concluded that A would most likely contain:
 - (a) Metallic bonding.
 - (b) Covalent molecular bonding.
 - (c) Covalent network bonding.
 - (d) Ionic bonding.
- 19. Using the table above which would have the highest boiling point?
 - (a) A
 - (b) B
 - (c) C
 - (d) A and B would both have high boiling points.

Question 21	(3 marks)
Complete the following by giving the	name or formula for the following:
(a) SO ₂	,
(b) Ammonium sulphite	
(c) AIPO ₄	
(d) Hydrogen carbonate ion	
(e) Dinitrogen pentoxide	
(f) CF ₄	
Over ation 20	(0 who)
Question 22 Draw an atom of lithium-7. Label the	(3 marks) major regions and the sub-atomic particles (with shells).

a)	An aqueo	An aqueous solution of hydrochloric acid is added to a strip of magnesium in a test tube. (2 marks)						
)ue	estion 24				(9 marks			
a)	Complete	the following	table.		(7 marks)			
		Neutrons	Protons	Electron Configuration	Gain or lose electrons to form ions?			
(Oxygen-17			J				
	²³ Na							
	²⁷ Al ⁺³				N/A			
	³⁷ Cl ⁻¹				N/A			
))				a. Describe the effects this for your answers.	is may have on its physical ar (2 mark			

(2 marks)

Question 23

Question 25 (8 marks)

(a) Draw dot diagrams (Lewis structures) for the following. Show all valence shell electron pairs as either: or — (6 marks)

Ne	(2 marks)
NH₄CI	(2 marks)
SO ₃	(2 marks)

(a)	Explain why neon does not form compounds like the other substances in question a. (2 marks)

Question 26				
phys	nonds, graphite and fullerenes are carbon based substances that have different chosical properties. Using your knowledge and understanding of these substances ans wing questions.			
(a)	Graphite is an allotrope of carbon. Define what is mean by the word 'allotrope'.	(2 marks)		
(b)	Explain why graphite can conduct electricity whilst diamond cannot.	(3 marks)		
(c)	Compare and contrast the arrangement of atoms within graphite with fullerenes.	(2 marks)		
(d)	Fullerenes are currently being studied to help in medical processes. State one pomedical use for fullerenes.	tential (1 mark)		

dran	properties of metallic, ionic, covalent molecular and covalent network substar natically. As a result they are used for different purposes. With reference to ch ount for the following scenarios:	
(a)	The differences in melting points of SO_2 (-72°C) and SiO_2 (1600°C).	(4 marks)
(b)	Aluminium conducts electricity more efficiently than sodium.	(3 marks)

(7 marks)

Question 29

arks)
a

Morphine ($C_{17}H_{19}NO_3$) is an opiate type of medication that is used for chronic pain. German pharmacist Freidrich Serturner was the first to derive morphine from the plant, opium poppy, in early 1800's. It is used for serious injuries, after operations and sometimes given during childbirth. It is a highly addictive medication that can cause drowsiness and vomiting.

				HO	~			
	culate the perd king steps.	entage	composition fo	or each	element in morp	ohine. I	Ensure to show	v all your
Que	estion 31							(10 marks)
Mag	nesium carbo	nate is	added to phos	phoric a	cid to form a co	lourles	s odourless ga	S.
(a)	Balance the	equatio	n below.					(1 mark)
	MgCO _{3(s)}	+	$H_3PO_{4(aq)}$	\rightarrow	Mg ₃ (PO ₄) _{2(s)}	+	H ₂ O _(l) +	CO _{2(g)}
If an	ı excess amoı	ınt of ph	osphoric acid	is adde	d to 2.75 gram o	of magr	nesium carbon	ate calculate:
(b)	The amou	nt of pho	osphoric acid c	consume	ed in moles.			(4 marks)

(3 ma
(2 ma

Within the human body certain types of reactions known as oxidation reactions produce harmful products that can lead to diseases. It has been suggested that certain chemicals found in foods can prevent these reactions occurring. These beneficial chemicals are therefore called antioxidants and can come in a variety of fruits and vegetables. Common antioxidants include vitamins A, C and E and are found in food such as carrots, blueberries, grapes, cranberries and sweet potato.

To determine the content of antioxidants in a particular food, the Briggs-Rauscher reaction is used. This is an oscillating chemical reaction that produces vivid colour changes. It starts at a dark blue colour and changes to colourless then yellow and back to dark blue. The time taken to complete one cycle of colour changes can determine the concentration of antioxidant in the food. The longer the time it takes for one cycle the more antioxidants the food will contain.

Below is a table of result from a student's investigation:

Food	Trial 1 (seconds)	Trial 2 (seconds)	Trial 3 (seconds)	Average (seconds)
Carrots	73	70	77	
Blueberries	289	296	227	
Grapes	84	93	89	
Cranberries	99	100	96	
Sweet potato	160	159	166	
Kale	205	208	203	

(a) Calculate the average time for each type of food.

(b)	Willelf food would fix	ave the highest level of	antioxidants?	(1 mark)
(c)	Identify the independ	dent variable.		(1 mark)
		Food	Average (seconds)	
		Carrots	72	
		Blueberries	251	
		Grapes	85	
		Cranberries	80	
		Sweet potato	163	
		Kale	205	
(e)	Identify one controlle	ed variable.		(1 mark)
This body The	results in less antioxi /. student ran the same	dants being consumed i	antioxidants decreases on order to stop oxidation and the Briggs-Rauscher its were collected.	reactions within the
(f)	Consider the information decreases when the		e the claim that, "the con	centration of antioxidant: (3 marks)

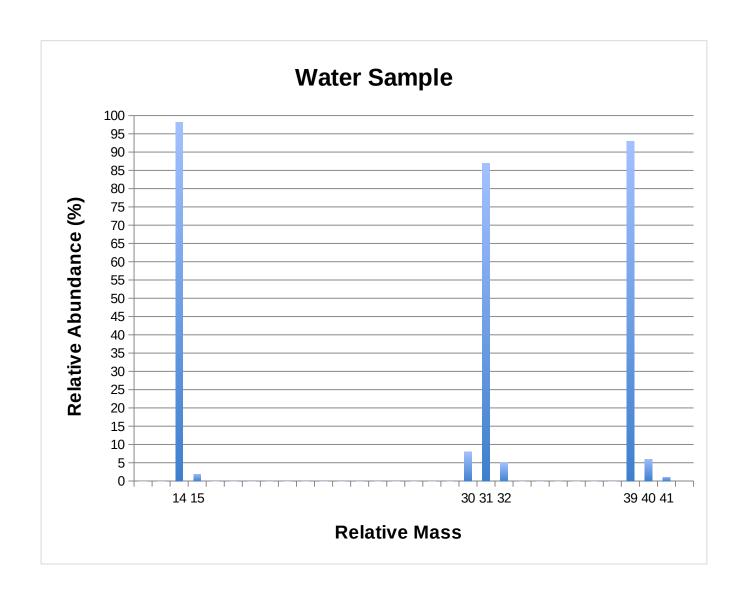
Question 33 (16 marks)

Fossil fuels such as coal and oil have played a major role in sustaining our energy needs. However these fuels are starting to become limited in supply and over recent times have been linked to environmental issues such as global warming.

Biofuels are an alternative form of energy that includes bioethanol, biogas and biodiesel. The production of bioethanol has started to occur in Australia. Bioethanol relies on the fermentation of crops (sugarcane, wheat or corn) to enable energy to be obtained.

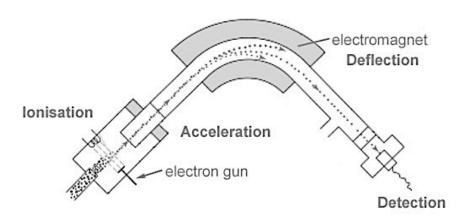
For the production of bioethanol to occur, large numbers of these food crops need to be planted. Farmers are now using substantial amounts of fertilisers to improve their crops yield. These fertilisers are high in chemical elements that enable plants to grow faster. This has led to problems associated with run-off that causes eutrophication and can result in algal blooms and fish dying.

Scientists from the Environmental Protection Authority collected a sample of water from a river that passes through a farm, which is known to grow corn for biofuels, after reports of fish dying in large numbers. It was tested using mass spectroscopy and the results shown below.



Determine the three elements that have resulted in the fish death, by calculating their relative molecular masses. All working out must be show to obtain marks. (6 marks)
Explain why the relative molecular mass of each element is not identical to those found on the periodic table. (2 marks)

(d) Describe each of the following steps of mass spectrometry.



(i) Ionisation (2 marks)

	(ii) Acceleration	(1 mark)
	(iii) Deflection	(3 marks)
Que	stion 34	(8 marks
nas l unno nado disco	otechnology is an emerging area of scientific endeavour. Much of the develope due to advances in high powered microscopy. One such microscope delling microscope, which owes its existence to scientists Gerd Binnig and He their discovery known in 1981. Some of the more well-known nanomater overy to Binning and Rhorer's work are buckminsterfullerene (bucky ball) a tubes.	is the scanning Heinrich Rohrer who ials owing their
a)	Define the term nanoparticle.	(1 mark)
b)	How do nanoparticles differ from their bulk material?	(2 marks)

With the us	e of a diagram, explain how na	noparticles have helped with UV protec	tion
sunscreens			(4
Sunscre	en without nanoparticles:	Sunscreen with nanoparticles:	
Describe or	ne concern that people may ha	ve with the use of nanoparticles in suns	cree (1

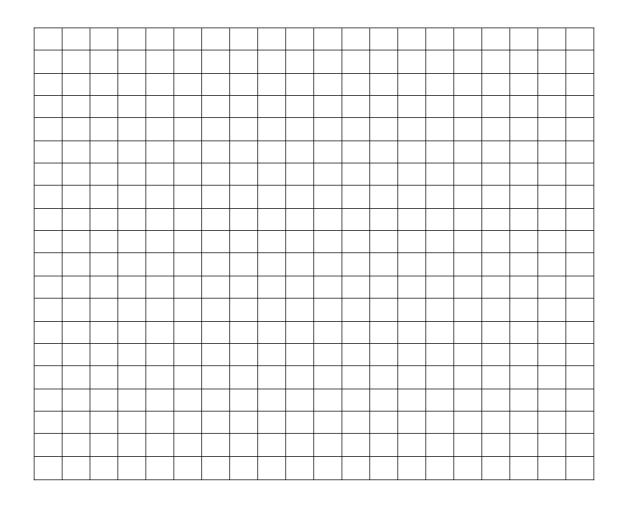
Sodium's eleven ionisation energies are listed below.

Number of electrons	Ionisation energy / kJ molL ⁻¹
1	496
2	4,562
3	6,910
4	9,543
5	13,354
6	16,613
7	20,117

8	25,496
9	28,932
10	141,362
11	159,075

(a) Graph these results.

(6 marks)



(b)	Describe the patterns that are seen in the graph. Include any irregularities.	(2 marks)
(c)	Suggest reasons for the observed patterns.	(3 marks)

Quest	tion 36 (4 marks)
Findin	gs from a range of scientific experiments have contributed to the understanding of the atom.
	of the most well-known scientists that have contributed to the Atomic Theory have been h John Thomson in the late 1890's and his successor Ernest Rutherford in the early 1900's.
For or	ne of these scientists:
(a) (b)	Describe the experiments they conducted that lead to their discovery. (1 mark) The conclusions they made about the atomic structure as a result of their findings. (3 marks)

