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VCE Chemistry ½
AOS 1 Revision I [1.12]
Test Solutions

30 Marks. 1 Minute Reading. 20 Minutes Writing

Results:

Test Questions	_____ / 25
Extension	_____ / 5

Section A: Test Questions (25 Marks)

Question 1 (3 marks)

Tick whether the following statements are **true** or **false**.

	True	False
a. Chlorine is typically unstable on its own as it has 7 electrons in the outer shell.	✓	
b. Noble gases do not react with any other atom since they already have a full valence shell according to the octet rule.	✓	
c. Hydrogen only has one valence electron, and so needs 7 more electrons in order to become stable.		✓
d. First ionisation energy decreases as you move across a period from left to right.		✓
e. Electronegativity refers to the ability of an atom to attract electrons towards itself.	✓	
f. The cesium atom has an effective nuclear charge of +1 whereas the bismuth atom has an effective nuclear charge of +6.	✓	

Space for Personal Notes

Question 2 (7 marks)

Jay is investigating the structure of atoms to prepare for his first chemistry SAC. To do this, he looks at a single oxygen atom, as presented on the periodic table.

a. What are the charges of protons and neutrons? (1 mark)

Proton: positive
Neutron: neutral

b. According to the Rutherford model, explain the structure of an oxygen atom. (2 marks)

Oxygen has a nucleus, which is surrounded by a cloud. This cloud has electrons inside of it. In the case of oxygen, there would be 8 electrons randomly distributed in this cloud.

c. With reference to the same model, explain why dispersion forces can form. (1 mark)

Electrons are randomly moving in the electron cloud around the nucleus, which can then create temporary dipoles in an atom.

d. How many protons and electrons are expected in a standard ^{16}O atom? (1 mark)

8 protons and 8 electrons.

e. After taking a strong interest in the findings of Ernest Rutherford, Jay decides to replicate his famous gold foil experiment. What did this experiment reveal about atoms, and how? (2 marks)

They found holds in the gold foil during the experiment. This revealed that atoms are mostly empty space with a tiny, dense and positively charged nucleus.

Question 3 (3 marks)

Nitrogen and oxygen are two of the most prominent gases which make up around 99% of the total gas volume in the atmosphere. Both molecules are essential to life on Earth and are used for various purposes.

a. Explain whether oxygen gas and nitrogen gas are polar. (1 mark)

No. This is because they are diatomic and thus, there is equal electron sharing.

b. Oxygen atoms are not found in their single state in nature and instead are almost always found in a diatomic state, such as in $O_2(g)$. Explain this observation. (2 marks)

This is because normally oxygen has 6 electrons in its outer shell. Thus, it is unstable and is only found when it forms covalent bonds to have 8 electrons in its outer shell.

Question 4 (4 marks)

State the parent and molecular geometry of the following:

a. CH_4. (1 mark)

Parent Geometry	Molecular Geometry
Tetrahedral	Tetrahedral

b. HCN. (1 mark)

Parent Geometry	Molecular Geometry
Linear	Linear

c. NH_3. (1 mark)

Parent Geometry	Molecular Geometry
Tetrahedral	Pyramidal

d. NOBr. (1 mark)

Parent Geometry	Molecular Geometry
Trigonal Planar	V-Shaped/Bent

Question 5 (5 marks)

Alexander wants to examine hydrogen bonding more in-depth in a chemistry lab.

a. State what is required for a hydrogen bond. (1 mark)

A hydrogen bond requires a hydrogen bonded to any of F/O/H, and that being next to another F/O/H.

b. Can a molecule such as HCl form hydrogen bonds? Explain your answer. If no, identify the strongest type of intermolecular force that will be present. (2 marks)

No, it cannot because Cl is not electronegative enough to isolate the hydrogen to allow a F/O/H to approach it closely. It will only have dipole-dipole bonds instead.

c. Would Alex expect a change if he put HCl and H_2O together? Justify your answer. (2 marks)

No, as HCl already does not have the isolated H that is required for hydrogen bonding, and Cl itself cannot approach other isolated H closely, adding H_2O does not assist with forming hydrogen bonds as the requirements are not met.

Question 6 (3 marks)

Between CO_2 and C_2H_6, predict which one has a higher boiling point and explain your answer.

C_2H_6 has a higher boiling point because it has stronger intermolecular bonding due to stronger dispersion forces. This arises due to C_2H_6 being a bigger molecule hence containing more electrons which increases the amount of temporary dipoles.

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Section B: Extension (5 Marks)

Question 7 (1 mark)

For an atom of Be, which statement is the MOST correct?

A. The valence electrons will be very difficult to remove as the atomic radius is small, thereby the nucleus will hold onto them strongly.

B. The valence electrons will want to achieve a full outer shell and will gain 6 electrons to do so.

C. The valence will be very easy to remove as the atomic radius is small, but the nucleus is also very small.

D. The Be atom will want to achieve a full outer shell and will lose 2 electrons to do so.

Question 8 (1 mark)

Which of the following molecules have a trigonal planar molecular geometry?

A. NH_3

B. BeF_2

C. BF_3

D. NO_2

Question 9 (1 mark)

Which of the following bonds are considered the least polar?

A. $O-H$

B. $N-H$

C. $H-F$

D. $H-Cl$

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Question 10 (1 mark)

Which of the following gives the correct shape for each of the molecules listed?

	Linear	V-shaped	Tetrahedral
A.	H_2O	NH_3	CH_4
B.	H_2	CO_2	NH_3
C.	HF	H_2O	NH_3
D.	CO_2	H_2S	CH_4

Question 11 (1 mark)

An unknown molecule is known to be polar in nature. It contains at least one oxygen atom. All of the following statements about the atom must be true except:

A. The molecule will form dispersion forces with itself.

B. The molecule will form dispersion forces and dipole-dipole attractions with itself.

C. The molecule will form dispersion forces, dipole-dipole attractions and hydrogen bonding with itself.

D. The molecule has a net dipole.

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