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Level: CIE AS and A Level (9701)

Subject: Chemistry

Topic: CIE Chemistry

Type: Mark Scheme

2002



1583

Chemistry CIE AS & A Level
To be used for all exam preparation for 2025+

CHEMISTRY

AS and A

This to be used by all students studying CIE AS and A level Chemistry (9701) But students of other boards may find it useful

Mark Scheme

Answer 1

The correct option is A because:

- The question is asking you to read the report and pick which fact stated in the report is incorrect.
- The report states the bromine gas was purple, this is wrong because bromine gas is not purple.
- Bromine gas is orange/brown.
- The colour of the gases of Group 17 elements:
 - Fluorine – pale yellow
 - Chlorine – green/yellow
 - Bromine – orange/brown
 - Iodine – black solid, purple vapour

B is incorrect as the report suggests that bromine vaporises easily (as the bromine was gaseous), this is true – bromine vaporises readily.

C is incorrect as the report states that bromine is denser than air (as the gas drifts over the road, forming a layer below air instead of rising), this is true – bromine gas is denser than air.

D is incorrect as the report suggests that bromine will dissolve in water to produce bromine water (as firemen were able to dissolve the gas), this is true – bromine is soluble in water. *Water induces a dipole in Br₂ enabling it to dissolve, however Br₂ dissolves more readily in organic solvents as it cannot form hydrogen bonds to water.*

Answer 2

The correct answer is A because:

- Chlorine is a diatomic molecule so each molecule of chlorine will have two atoms.
- Each of those atoms will have the same radius as the radius is determined by the number of electrons
- The molecular mass of the atom is determined by the number of neutrons in the nucleus.
- In the diatomic molecule, chlorine can have combinations of isotopes:
 - $^{35}\text{Cl} + ^{35}\text{Cl}$, molecular mass = 70
 - $^{35}\text{Cl} + ^{37}\text{Cl}$, molecular mass = 72
 - $^{37}\text{Cl} + ^{37}\text{Cl}$, molecular mass = 74
 - As the molecular mass of this molecule is 72, it will have the $^{35}\text{Cl} + ^{37}\text{Cl}$ atoms

B is incorrect as the isotopic mass is different between the two atoms.

C & D are incorrect as the nucleon number is the number of protons and neutrons. Since the number of neutrons is different in isotopes, the nucleon number will not be the same.

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Answer 3

The correct answer is A because:

- There are only weak van der Waals' forces between the diatomic molecules, caused by instantaneous dipole-induced dipole forces.
- These forces increase as you go down Group 17 as the number of electrons in the molecules increase.
- The greater the number of electrons the greater the chance of instantaneous dipoles arising within molecules inducing dipoles in neighbouring molecules.
- The larger the molecules, the stronger the van der Waals' forces.
- Therefore, iodine has a stronger force than fluorine.

B is incorrect as the bond length increases in Group 17 as you go down the group.

C is incorrect as the bond energy decreases as you go down Group 17.

D is incorrect as the boiling point of Group 17 increases as you go down the group.

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