Turnbull High School

Department of Chemistry

Exam Questions for CfE Higher Chemistry

Unit 1 Chemical Changes and Structure

**MARK SCHEME**



**1.1 Controlling the Rate**

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| Question | Source | Answer |
| 1 | 2007 | C |
| 2 | 2009 | D |
| 3 | 2008 | A |
| 4 | 2010 | D |
| 5 | 2010 | C |
| 6 | 2013 | A |
| 7 | 2008 | D |
| 8 | 2010 | B |
| 9 | 2011 | D |
| 10 | 2007 | C |
| 11 | 2008 | C |
| 12 | 2009 | B |
| 13 | 2011 | C |
| 14 | 2012 | B |
| 15 | 2010 | B |

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| --- | --- | --- |
| Q | Source | **Correct** |
| 16 | 2007 B 6 | **(a) (i) (**Purple (pink) to colourless **or** purple (pink) disappears (goes away) **1****(ii)** Temperature measured during heating is only roughly measured**or** because the temperature may continue to rise (change) when you stop heating**or** because the temperature at the end is measured accurately**or** there might be a time delay between heating and carrying out the experiment**or** during heating, the temperature of the solution may rise too quickly**or** because the temperature goes up when you add the oxalic acid**or** addition of the oxalic acid may cool the solution **1****(b)** More molecules (particles) have enough energy to collide successfully**or** more molecules have sufficient energy to react**or** more molecules with (kinetic) energy greater than the activation energy(Accept clearly labelled additions to the diagram) **1** |
| 17 | 2008 B 3 | **(a)** a certain volume of KI solution was measured out and the volume made up to 25 cm3 with water (and this was repeated)**or** 20 cm3 KI solution added to 5 cm3 of water; 15 cm3 KI solution to 10 cm3 of water etc. **1****(b)** rate = 1/time so time = 1/rate = 1/0.043 = 23.3s |
| 18 | 2009 B 11 | more collisions with energy greater or equal to Ea or more collisions leading to an activated complex or correct energy distribution diagram **1** |
| 19 | 2008 B 14 | Homogenous **1** |
| 20 | 2007 B 10 | Experiment 2 curve initial gradient steeper than experiment 1 (**½)**curve levels off at approximately same volume as experiment 1 (**½)**experiment 3 curve initial gradient less steep than experiment 1 (**½)**levels off at approximately half final volume of experiment 1 (**½) 2** |

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| 21 | 2010 B 5 | **(a) (i)** concentration of reactants(or permanganate or oxalic acid) **(½)**volume of reactants (or permanganate or oxalic acid) (½) **1****(ii)** colour change is too slow (or too gradual or takes a long time)**or** colour change is indistinct **1****(b)**  |
| 22 | 2009 B 7 | **(a)** use an (upturned) measuring cylinder (or graduated tube) filled with water or collect gas over water or correct diagram **1****(b)** mass (or weight) or pH or concentration of acid or conductivity **1** |
| 23 | 2010 B 9 | **(a)** carbon, oxygen, nitrogen and hydrogen [accept C, O (or O2), N (or N2), H (or H2)]  **1****(b)** count the number of (oxygen or gas) bubbles produced in a given timeor measure the volume of gas produced in a given time or measureheight of bubbles (or foam) produced in a given time or find rate of gas production (ignore wrong gas named) **1****(c)** increasing temperature can denature the enzyme or idea of optimumtemperature **1** |
| 24 | 2011 B 1 | **(a)** Homogeneous **1****(b) (i)** Answer 0·0015 Units not required **1****(ii)** New line should start at same point as original and should have a steeper gradient (both aspects required for mark) **1** or zero(No need to consider where their sketched graph finishes/levels off etc) |

**1.2 Periodicity**

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| Question | Source | Answer |
| 1 | 2007 | C |
| 2 | 2009 | D |
| 3 | 2008 | B |
| 4 | 2009 | C |
| 5 | 2012 | B |
| 6 | 2013 | D |
| 7 | 2013 | C |
| 8 | 2013 | D |
| 9 | 2010 | A |
| 10 | 2010 | D |
| 11 | 2011 | C |
| 12 | 2008 | B |
| 13 | 2009 | C |
| 14 | 2013 | B |
| 15 | 2013 | C |
| 16 | 2008 | D |
| 17 | 2008 | A |
| 18 | 2007 | C |
| 19 | 2009 | C |
| 20 | 2008 | C |
| 21 | 2010 | D |

|  |  |  |
| --- | --- | --- |
| Q | Source | **Correct** |
| 22 | 2010 B 1 | lithium metallic (or metal) (½)boron covalent (½) network or lattice (½)nitrogen (discrete) molecular (or molecule) or diatomic (½) **2** |
| 23 | 2008 B 9 | weak (½) van der Waals’ forces (½)second mark for further clear explanation of origins of van der Waals’ forces along the lines of instantaneous (or momentary or non-permanent) dipoles (or attractions) (½) caused by movement of electrons (½) **1** |
| 24 | 2007 B 1 | **(a)** Electronegativity **1****(b)** Decreases or gets smaller **1****(c)** Bigger atom or larger size or more electron shells**or** outer electron is further from the nucleus (or protons) (1)Second mark for a further clear explanation, eg inner electrons (electron shells) reduce the attraction between the nucleus and the outer electron**or** inner electrons (electron shells) shield (screen) the outer electron fromthe attraction of the nucleus (1) **2** |
| 25 | 2012 B 1 | **(a) (i)** Boron or Carbon or B or C or graphite or diamond **1****(ii)** Number of protons increasesor increased atomic numberor greater nuclear/positive charge (pull)or greater pull on (outer) electrons **1****(iii)** Lithium or Li **1****(b)** Electrons are further from the nucleus **or** atomic size increases **or** extra energy level (1)Screening or shielding or explanation thereof (1) **2** |
| 26 | 2009 B 1 | **(a)** increases (or gets bigger or rises) **1****(b)** more energy is needed to remove the electron from a full shell (or complete shell or noble gas shell)**or** an electron is being removed from an energy level closer to the nucleus**or** there is a greater nuclear pull on the electron being removed**or** second energy level is nearer the nucleus**or** second energy level is full (or complete), etc. **1****(c)** forces of attraction between molecules (or intermolecular forces or van der Waals’ forces) increase**or** energy needed to separate the molecules increases. **1** |
| 27 | 2009 B 11 | the outer electron in potassium is further from the nucleus or the outer electron is in a higher (or the fourth) energy level (½) or the inner shells screen (or shield) the outer electron from the (pull of the) nucleus (½) or corresponding explanation based on chlorine **1** |
| 28 | 2011 B 2 | **(a) (i)** more protons or increasing nuclear charge **1****(ii)** Cl(g) 🡪 Cl+(g) + e-Cl(g) - e- 🡪 Cl+(g)(no penalty if negative sign omitted from electron) **1****(b)** Argon does not form (covalent) bondsOr No electrons involved in bonding **1** |
| 29 | 2013 B 1 | **(a) (i)** K(g) → K+(g) + e– (1) or K(g) → K+(g) + e **1****(ii)** Answers can be given either in terms of potassium or of chlorineAnswers starting with “it” are assumed to refer to PotassiumEitherK has more shells/levels or electron further from nucleus or diagram showing this **1**Correct and clear use of greater shielding/screening (or clear explanation thereof) **1**So less energy required to remove electron/ weaker attraction for the electron **1****Or** Cl has fewer shells or electron closer to nucleus **1**Correct and clear use of less shielding/screening (or clear explanation thereof) **1**So more energy required to remove electron/stronger attraction for the electron **1** |
| 30 | 2010 B 11 | **(a) (i)** outer electron is further away from the nucleus**or** greater number of electron shells **1**(increased) shielding (or screening) by the inner electrons**or** decreased nuclear attraction due to inner election shells **1** **(ii)** 3.94 × 10-21 × 6 × 1023 (½) = 2371.9 kJ mol-1 (½) **1**(no units required; accept kJ)**(b)** Cl(g) + e- → Cl-(g) **1** |

**1.3 Structure and Bonding**

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| --- | --- | --- |
| Question | Source | Answer |
| 1 | 2007 | B |
| 2 | 2007 | D |
| 3 | 2011 | A |
| 4 | 2007 | A |
| 5 | 2008 | A |
| 6 | 2007 | D |
| 7 | 2007 | A |
| 8 | 2007 | B |
| 9 | 2010 | B |
| 10 | 2012 | C |
| 11 | 2012 | D |
| 12 | 2012 | B |
| 13 | 2012 | C |
| 14 | 2010 | B |
| 15 | 2009 | D |
| 16 | 2012 | C |
| 17 | 2013 | D |
| 18 | 2008 | C |
| 19 | 2009 | C |
| 20 | 2012 | D |

|  |  |  |
| --- | --- | --- |
| Q | Source | **Correct** |
| 21 | 2007 B 13 | hydrogen bonds (½)which are strong or strong bonds between ammonia moleculesor strong intermolecular bonding (½)second mark for further clear explanation of origins of hydrogenbonding along the lines of big difference in electronegativity between N and H (½)N to H covalent bonds very polar (½)(Accept diagram showing above points) **2** |
| 22 | 2008 B 1 | CO2 covalent molecular (or molecules)**or** discrete covalent (molecular or molecules) **1**SiO2 covalent network or covalent lattice **1** |
| 23 | 2010 B 7 | intermolecular attractions (or forces)**or** attractions between molecules (1)any mention of a difference in electronegativity (½)carbon (or hydrogen) has a small positive charge and nitrogen a small negative charge (½)(accept diagram with key points, maximum 1½ marks if mention ofhydrogen bonding) **2** |
| 24 | 2011 B 3 | **(a)** Covalent bonds not being broken**OR** Intermolecular bonds that are breaking(accept alternative wording that demonstrates candidate recognises that covalent bonds are not broken when covalent substances melt/boil) **1****(b)** Formula refers to the ratio of Mg2+:Cl- ions (in lattice) (or alternative wording ie in the lattice there are twice as many chloride ions as magnesium ions) **OR** Mg2+ ions surrounded by > 2 Cl- ions **OR** Cl- surrounded by >1 Mg2+ **2** |
| 25 | 2012 B 7 | **(a)** 2.9 **1****(b)** covalent **1****(c)** Cross at (2.6, 0.8) on graph **2**For calculation of both average electroneg. = 2.6 and diff. electroneg. = 0.8 **(1)**For correctly plotting the point for the values candidate has calculated **(1)** |
| 26 | 2013 B 3 | Stating that one (CHCl3) is polar and/or the other (CCl4) is non-polar (1)Identifying that CHCl3 has permanent dipole/permanent dipole attractions and identifying that CCl4 has London dispersion forces (1)Other mark is for a statement linking intermolecular forces/polarity to the solubility in water such as water is polar (1)**Or** water has permanent dipole/ permanent dipole attractions (1)**Or** water is a good solvent for polar molecules (1)**Or** like dissolves like (1) **3** |