**Questions**

**Q1.**

All alkenes have

   **A**    the same empirical formula and the same general formula.

   **B**    the same molecular formula and the same general formula.

   **C**    the same molecular formula and the same empirical formula.

   **D**    the same empirical formula and the same structural formula.

**(Total for Question = 1 mark)**

**Q2.**

The first ionization energies, in kJ mol-1, of four elements with consecutive atomic  
 numbers are shown below.

**A**    1680

**B**    2080

**C**    496

**D**    738

(a) Which element could be an inert gas?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b) Which element could be X in a covalent compound with formula HX?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c) Which element could be Y in an ionic compound with formula YH2?

**(1)**

   **A**

   **B**

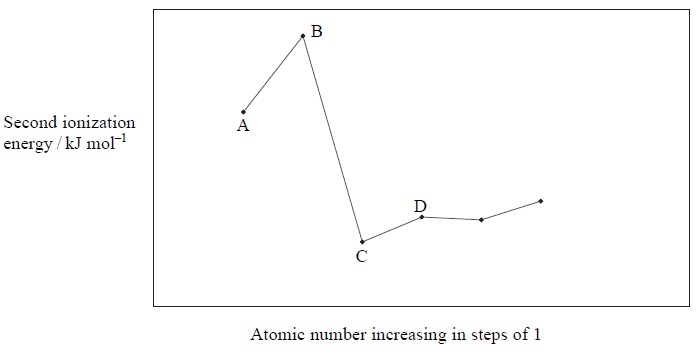
   **C**

   **D**

**(Total for question = 3 marks)**

**Q3.**

The graph below shows the **second** ionization energy of a series of elements with  
 consecutive atomic numbers.



Which element could be lithium?

   **A**

   **B**

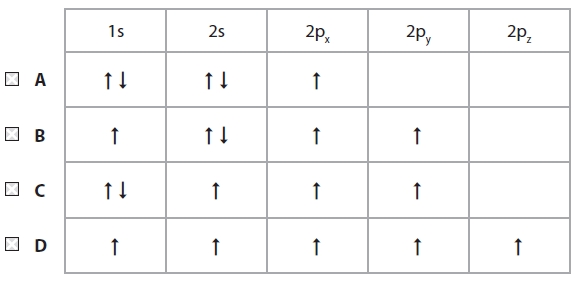
   **C**

   **D**

**(Total for question = 1 mark)**

**Q4.**

Which of the following diagrams represents the electrons in the ground state of a boron atom?



**(Total for question = 1 mark)**

**Q5.**

The first five ionization energies, in kJ mol-1, of aluminium are

578     1817     2745     11 578     14 831

The orbitals from which the first five electrons are removed during ionization, starting  
 with the first electron, are

   **A**      1s  2s  2p  3s  3p

   **B**      1s  1s  2s  2s  2p

   **C**      3p  3s  2p  2s  1s

   **D**      3p  3s  3s  2p  2p

**(Total for question = 1 mark)**

**Q6.**Which pair of ions is isoelectronic?

   **A**    Ca2+ and O2−

   **B**    Na+ and O2−

   **C**    Li+ and Cl−

   **D**    Mg2+ and Cl−

**(Total for Question = 1 mark)**

**Q7.**

A particle with a **single** positive charge and with the electronic configuration 1s2 2s2 2p6 is

   **A**    a sodium ion.

   **B**    a fluoride ion.

   **C**    an oxide ion.

   **D**    a potassium ion.

**(Total for question = 1 mark)**

**Q8.**

When an Al4+ ion is formed from an Al atom, the fourth electron is lost from the

   **A**     1s sub-shell.

   **B**     2s sub-shell.

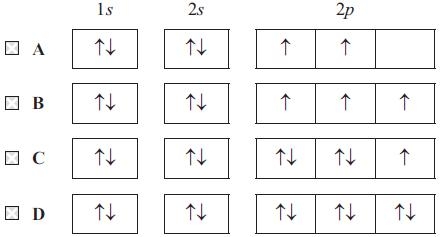
   **C**     2p sub-shell.

   **D**     3s sub-shell.

**(Total for question = 1 mark)**

**Q9.**

The electronic structures of four elements are given below. Which of these elements has the highest first ionization energy?



**(Total for question = 1 mark)**

**Q10.**

If **X** represents the element of atomic number 9 and **Y** the element of atomic number 20, the compound formed between these two elements is

   **A**    covalent, **YX**2.

   **B**    ionic, **YX**2.

   **C**    covalent, **YX**.

   **D**    ionic, **YX**.

**(Total for question = 1 mark)**

**Q11.**

Which of the following formulae for compounds of germanium, Ge, is unlikely to be  
 correct, given the position of germanium in the Periodic Table?

   **A**     GeF3

   **B**     GeS2

   **C**     GeO2

   **D**     GeH4

**(Total for question = 1 mark)**

**Q12.**

The electronic structure of an atom of an element in Group 6 of the Periodic Table could  
 be

   **A**     1s2 2s2 2p2

   **B**     1s2 2s2 2p4

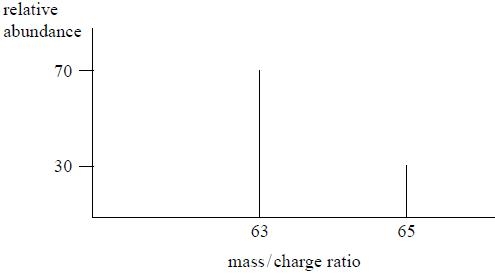
   **C**     1s2 2s2 2p6 3s2 3p6 3d6 4s2

   **D**     1s2 2s2 2p6 3s2 3p6 3d10 4s2 4p6

**(Total for question = 1 mark)**

**Q13.**

The mass spectrum for a sample of a metal is shown below.



The relative atomic mass of the metal is

   **A**     63.2

   **B**     63.4

   **C**     63.6

   **D**     64.0

**(Total for question = 1 mark)**

**Q14.**

The equation representing the reaction between copper(II) oxide and dilute sulfuric acid is

CuO(s) + H2SO4(aq) → CuSO4(aq) + H2O(l)

The **ionic** equation for the reaction is

   **A**    Cu2+(s) + SO42−(aq) → CuSO4(aq)

   **B**    O2−(s) + H2SO4(aq) → H2O(l) + SO42−(aq)

   **C**    CuO(s) + 2H+(aq) → Cu2+(aq) + H2O(l)

   **D**    CuO(s) + H2SO4(aq) → Cu2+SO42−(aq) + H2O(l)

**(Total for question = 1 mark)**

**Q15.**Which of the following equations represents the **second** ionization energy of chlorine?

   **A**    Cl+(g) → Cl2+(g) + e−

   **B**    Cl(g) → Cl2+(g) + 2e−

   **C**    Cl(g) → Cl2−(g) − 2e−

   **D**    Cl−(g) → Cl2−(g) − e−

**(Total for Question = 1 mark)**

**Q16.**The first five ionization energies of an element, **X**, are

578, 1817, 2745, 11578 and 14831 kJ mol−1, respectively.

In which group of the Periodic Table is **X** found?

   **A**    1

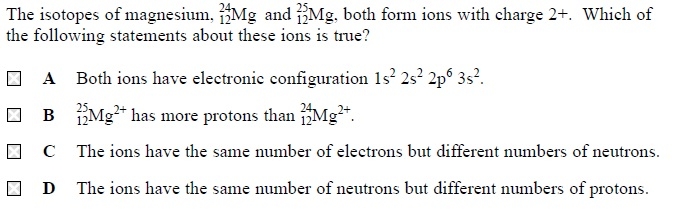
   **B**    2

   **C**    3

   **D**    4

**(Total for Question = 1 mark)**

**Q17.**



**(Total for question = 1 mark)**

**Q18.**

An isotope of an element, atomic number z, has mass number 2z + 4. How many neutrons are in the nucleus of the element?

   **A**     z + 4

   **B**     z + 2

   **C**     z

   **D**     4

**(Total for question = 1 mark)**

**Q19.**

The electronic configurations of the atoms of four different elements are given below.  
 For which element would you expect the value of the first ionization energy to be the  
 largest?

   **A**     1s1

   **B**     1s2

   **C**     1s2 2s1

   **D**     1s2 2s2

**(Total for question = 1 mark)**

**Q20.**Bromine has two isotopes with relative isotopic masses 79 and 81. Which of the following values for mass/charge ratio could correspond to a peak in the mass spectrum of bromine, Br2? You should assume the ions detected have a single positive charge.

   **A**    79.9

   **B**    80

   **C**    159

   **D**    160

**(Total for Question = 1 mark)**

**Q21.**

Chlorine has two isotopes with relative isotopic mass 35 and 37. Four *m/z* values are  
 given below. Which will occur in a mass spectrum of chlorine gas, Cl2, from an ion  
 with a single positive charge?

   **A**      35.5

   **B**      36

   **C**      71

   **D**      72

**(Total for question = 1 mark)**

**Q22.**

Which of the following ions would undergo the greatest deflection in a  
 mass spectrometer?

   **A**     35Cl2+

   **B**     35Cl+

   **C**     37Cl+

   **D**     35Cl37Cl+

**(Total for question = 1 mark)**

**Q23.**

The correct sequence for the processes that occur in a mass spectrometer is

   **A**    vaporization, ionization, acceleration, deflection and detection.

   **B**    vaporization, acceleration, ionization, deflection and detection.

   **C**    ionization, vaporization, acceleration, deflection and detection.

   **D**    ionization, vaporization, deflection, acceleration and detection.

**(Total for question = 1 mark)**

**Q24.**

In which of the following series of elements is there an **increase** in the melting temperatures from left to right?

   **A**    Na Mg Al

   **B**    Li  Na  K

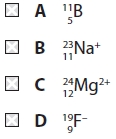
   **C**    B   C   N

   **D**    Si  P    S

**(Total for question = 1 mark)**

**Q25.**

Which of the following species contains the same number of electrons as neutrons?



**(Total for question = 1 mark)**

**Q26.**For Period 3 of the Periodic Table, from sodium to argon, what is the trend in the melting temperatures of the elements?

   **A**    A steady decrease

   **B**    A steady increase

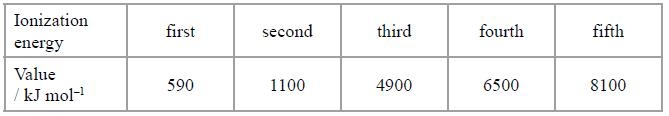
   **C**    A decrease to silicon then an increase

   **D**    An increase to silicon then a decrease

**(Total for Question = 1 mark)**

**Q27.**

The first five successive ionization energies of an element, **X**, are shown in the table  
 below.



Which ion is **X** most likely to form when it reacts with chlorine?

   **A**     **X**+

   **B**     **X**2+

   **C**     **X**3+

   **D**     **X**4+

**(Total for question = 1 mark)**

**Q28.**

The first five ionization energies of an element, **Z**, are:  
  
 790, 1600, 3200, 4400, 16100 kJ mol−1  
  
 In which group of the Periodic Table is **Z** found?

   **A**     2

   **B**     3

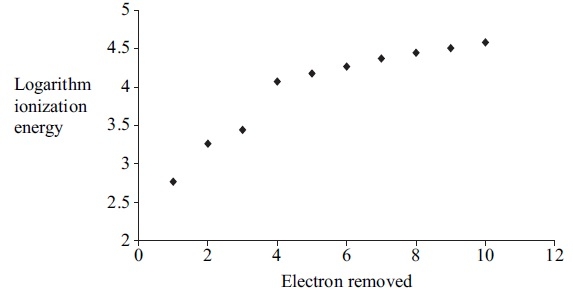
   **C**     4

   **D**     5

**(Total for question = 1 mark)**

**Q29.**

The graph below represents the successive ionization energies of an element **X** plotted against the number of the electron removed. **X** is not the symbol for the element.



(a) From this graph it is possible to deduce the group in the Periodic Table to which **X** belongs. **X** is in

**(1)**

   **A**      Group 1

   **B**      Group 3

   **C**      Group 5

   **D**      Group 7

(b) From the graph it is possible to deduce that the most stable ion of **X** will be

**(1)**

   **A**      X3+

   **B**      X+

   **C**      X−

   **D**      X3−

**(Total for question = 2 marks)**

**Q30.**The first eight ionization energies of an element are (in kJ mol−1):

789, 1577, 3232, 4356, 16091, 19785, 23787, 29253.

   **A**      Group 1

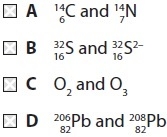
   **B**      Group 2

   **C**      Group 3

   **D**      Group 4

**(Total for question = 1 mark)**

**Q31.**Which of the following represents a pair of isotopes?



**(Total for Question = 1 mark)**

**Q32.**

Which of these statements is **incorrect?**

   **A**   The atomic radius of metals increases down a Group.

   **B**   The trend in the melting temperature of successive elements across Period 2 is  
              similar to that in Period 3.

   **C**   A metallic structure is held together by attractions between metal atoms and  
              delocalized electrons.

   **D**   Na+ and O2- ions are isoelectronic.

**(Total for question = 1 mark)**

**Q33.**

Which pair of atomic numbers represents elements which are both in the p-block of the  
 Periodic Table?

   **A**     4, 8

   **B**     6, 12

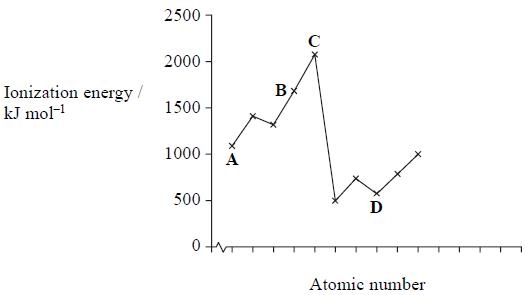
   **C**     8, 16

   **D**     10, 20

**(Total for question = 1 mark)**

**Q34.**

The sketch graph below shows the trend in first ionization energies for some elements in  
 Periods two and three.



Select, from the elements **A** to **D**, the one that  
  
 (a) has atoms with five p electrons.

**(1)**

   **A**

   **B**

   **C**

   **D**

(b) is a member of Group 3.

**(1)**

   **A**

   **B**

   **C**

   **D**

(c) is likely to be very unreactive.

**(1)**

   **A**

   **B**

   **C**

   **D**

(d) normally forms four covalent bonds per atom.

**(1)**

   **A**

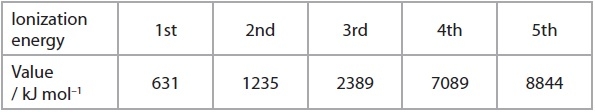
   **B**

   **C**

   **D**

**(Total for question = 4 marks)**

**Q35.**The first five ionization energies of an element, **X**, are shown in the table.



What is the mostly likely formula of the oxide that forms when **X** burns in oxygen?

   **A**    X2O

   **B**    XO

   **C**    X2O3

   **D**    XO2

**(Total for Question = 1 mark)**

**Q36.**

Going across the Periodic Table from sodium to aluminium,

   **A**      the melting temperature increases.

   **B**      the radius of the atom increases.

   **C**      the radius of the metal ion increases.

   **D**      the bonding in the element changes from metallic to covalent.

**(Total for question = 1 mark)**

**Q37.**

White phosphorus consists of

   **A**     a giant structure of atoms.

   **B**     a giant structure of ions.

   **C**     small molecules.

   **D**     single atoms.

**(Total for question = 1 mark)**

**Q38.**

In which of the following cases would a cation be most polarizing?

**Radius**          **Charge**

   **A**                        small               small

   **B**                        small               large

   **C**                        large               small

   **D**                        large               large

**(Total for question = 1 mark)**

**Q39.**

Which of these equations represents the electron affinity of chlorine?

   **A**   Mg+(g)         → Mg2+(g) + e-

   **B**   Mg(g)           → Mg2+(g) + 2e-

   **C**   Mg+(g) + e-  → Mg2+(g)

   **D**   Mg(g) + 2e- → Mg2+(g)

**(Total for question = 1 mark)**

**Q40.**

The equation for the complete combustion of pentane is



The standard enthalpy change of formation of CO2(g) is −394 kJ mol−1 and that of H2O(l) is −286 kJ mol−1.

The standard enthalpy change of formation of pentane (in kJ mol−1) is

   **A**    5(−394) + 6(−286) + (−3509)

   **B**    5(−394) + 6(−286) − (−3509)

   **C**    −5(−394) − 6(−286) + (−3509)

   **D**    −5(−394) − 6(−286) − (−3509)

**(Total for Question = 1 mark)**

**Q41.**

The nucleus of a  atom contains

   **A**     11 protons and 12 neutrons.

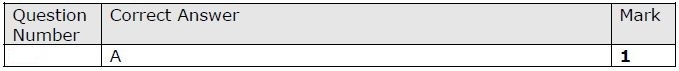
   **B**     11 protons and 12 electrons.

   **C**     23 protons and 11 neutrons.

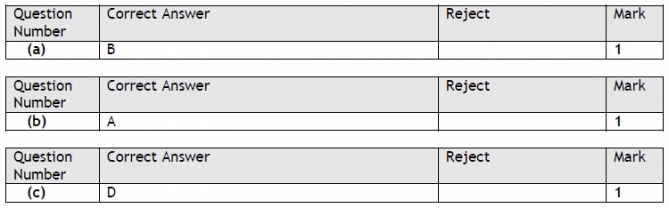
   **D**     23 protons and 11 electrons.

**(Total for question = 1 mark)**

**Mark Scheme**

**Q1.**

**Q2.**



**Q3.**



**Q4.**



**Q5.**



**Q6.**



**Q7.**



**Q8.**



**Q9.**



**Q10.**



**Q11.**



**Q12.**



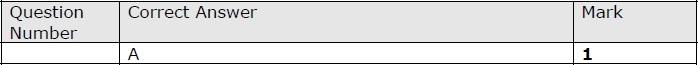
**Q13.**



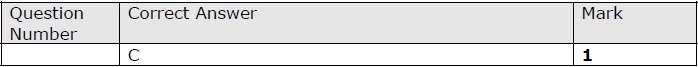
**Q14.**



**Q15.**



**Q16.**



**Q17.**



**Q18.**



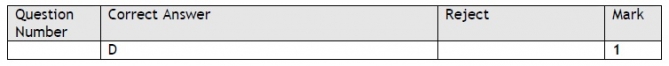
**Q19.**



**Q20.**



**Q21.**



**Q22.**



**Q23.**



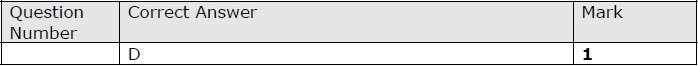
**Q24.**



**Q25.**



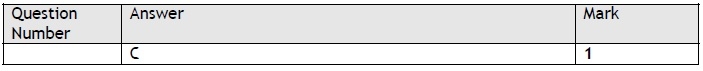
**Q26.**



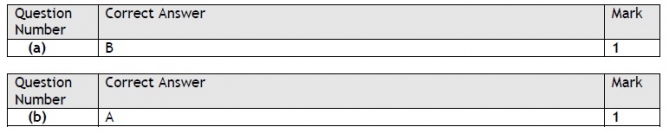
**Q27.**



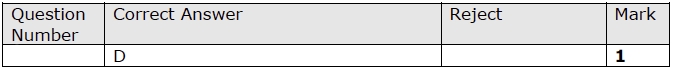
**Q28.**



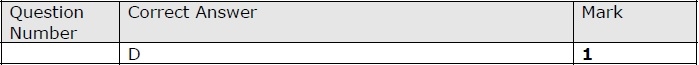
**Q29.**



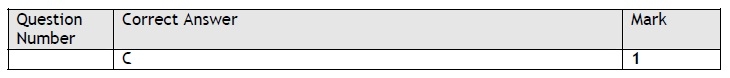
**Q30.**



**Q31.**



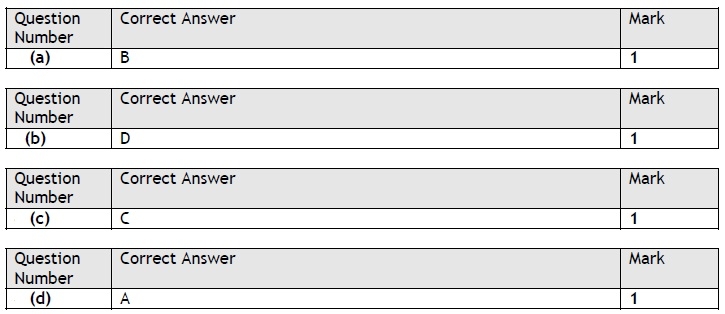
**Q32.**



**Q33.**



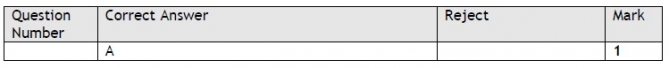
**Q34.**



**Q35.**



**Q36.**



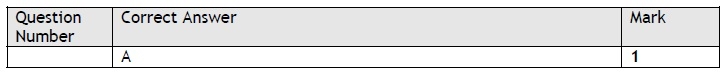
**Q37.**

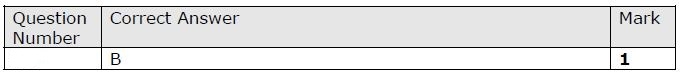


**Q38.**



**Q39.**



**Q40.**

**Q41.**

