STRUCTURE OF THE ATOM, PERIODIC TABLES AND CHEMICAL FAMILIES MARKING SCHEME

1. 1989 Q1a P1

(i) 7 the relative atomic mass is closer to 7

(ii) Neutrons-4, electrons =3

2. 1989 Q13 P1

(i) 2.8.8

(ii) Discharge Tube

3. 1989 Q33 P1

(a) (i) No reaction, no more NaOH

(ii) 33+/-0.5cm^3

(iii) 67^0C

(iv) (50+33) × 67 × 4.2J =23356.2 Joules

Moles of NAOH $= \frac{50 \times 1}{1000} = 0.05$moles

Neutralization $= \frac{23356.2 \times 10}{0.05} = 467.1$kj/mole

(b) (i) WCL_2

(ii)NaCL and $MgCL_2$ –have the highest boiling points

(iii)No, reason, Group VIII elements are inert.

5. 1990 Q1 P1

(a) P is more reactive than Q Reasons

(I)Metallic atoms loose electrons more readily down the group

(b) Electron arrangement Q = 2.8.2; P = 2.8.8.2. or differ by one energy level Atomic mass of P = 2+8+8+2 = 20

6. 1990 Q11 P1

(a) 2.8.5

(b) E forms covalent chloride/ molecular chloride burning Kerosene

7. 1991 Q2 P1

(i) S group, explanation: atomic radius increase downwards

(ii) They are metal

8. 1991 Q8 P1

(a) Neutrons = 69-31 = 38

(b) $\frac{69 \times 60.4}{100} + \frac{71 \times 39.6}{100}$

= 41.676 = 28.116

= 69.8(69.792)

9. 1991 Q30 P1

(a) (i) B-2.8.2
F-2/8.6
(ii)B-basic
F-Acidic

(b) Allotropy/Allotropic

(i)A ⟶ C Number of outermost electrons increases / atomic radii decreases hence metallic bond strengthen/ strength increase

(ii)D exhibits a giant atomic (covalent) structure each C atom is bounded by four covalent/strong bonds between atoms

10. 1992 Q1 P1

(i) Y^{2+} = 2.8.8
(ii) W^{2} = 2.8.8

11. 1993 Q1 P1

(a) X = 2.8.8.2
Y = 2.6

(b) Ionic or electrovalent

12. 1993 Q23 P1

(a) (i) v

(ii) S

(iii)Q because it needs to either loose or gain for electrons, thus its tendency to share electrons is high.

(iv)Alkali metals

(v)Rand S are in some period, across the period nuclear attraction increase, nuclear charge increases / greater attraction by nuclear hence atomic radius decreases.

13. 1994 Q1 P1

Protons = 27, Neutrons = 32, Electrons = 27

$= 3.78\times10^{5}$kg

14. 1995 Q1 P1

a) X -2, 8, 3 , √ (1marks)

Y- 2, 8 6 √ (1marks)

b) X_2Y_3 √ OR Al_2S_3 (1 mark)

15. 1995 Q12 P1

Hydrogen forms compounds by losing one electron like group I elements or by

gaining one electron like group VII element /Hydrogen has one electron in outermost shell. (2 marks)

16. 1996 Q6, 15 P1

6. a) G
b) E

15. a) X, both energy levels are full i.e 2:8 outer energy level full/has octane structure/inert gas structure.
b) (i) W and Y
(ii) YW

17. 1997 Q23 P1

a) - period 3 / Third period
- Y^{3-} / p^3
- Ionic radius is large – Atomic radius smaller
- Incoming electron repelled by electron in shell / energy level.

18. 1997 Q3 P2

i) G, H, L ($^1/_2$ Mark if 2)
Reason = Have a 1, 2, 2 e's respectively in outer orbit / their
Chlorides have a high M.P easily looses e's / outer orbital have less than 4 e's.

ii) HK or Mgs (not KH or smg)

iii) J has strong covalent bonds / has a giant covalent / atomic structure / weak van der waals between molecules.

iv) +4 /4^+

v) I – M.P of fluoride of G is higher because fluorine is more reactive than chlorine/forms stronger ionic bonds G than chlorine/Fluorine is more electronegative
II – reactivity of L is higher. Reactivity within metallic group increases down the group and L is below H. L looses e's easily // L is more electropositive.

19. 1998 Q7 P2

(a) (i) S and W
(ii) T, U, V
(b) (i) V(I) it is the only element whose boiling point is below 298K
(ii) V
(c) (i) $T(NO_3)_3$
(ii) $2S + U\ S_2U$
(d) Ionic (I) T. Is a metal while U is a non- metal (½). Therefore T loses electrons to U. T is electropositive while U electronegative. (½)
(e) (i) Cathode
Hydrogen (I)
(ii) Anode
Oxygen (I)

20. 1998 Q15 P1

(a) (i) - F
(ii) - I

21. 1998 Q7bP1

(a) IV, II, I,III

22. 1999 Q7 P1

C = 2.3; Valency 3

C2S3 OR C2S5

23. 1999 Q3a-d P2

(a) M = 2.8, Q = 2.8.8

(b) (i) Q

(ii) Q or N

(c) 4, Four

(d) R has a large atomic radius than L (water) in its outermost electron is not tightly held in its nucleus (I)

24. 2000 Q5 P1

a) $T_{(s)} + X^{2+\,(aq)} \longrightarrow T^{2+}_{(aq)} + X_{(s)}$

b) SXTU

25. 2000 Q1 P2

a) i) Alkaline earth metals

ii) A

iii) Covalent

They form bond by sharing of electrons:

iv) D_2O_3 or Al_2O_3

v) Tick or G is in the right place

b) i) H Their boiling points are quite close

ii) K

iii) I L its boiling point is lower than room temperature and is slightly soluble in water.

II J

26. 2001 Q3 P1

(a) (i) B ‖Magnesium ‖2.8.2

(ii) C ‖Sodium ‖2.8.1

(b) D‖ Argon ‖2.8.8.2

27. 2001 Q13 P1

G3, because it has the smallest atomic radius. Its outer most electron is tightly held by the nucleus or it requires a lot of energy to remove it.

28. 2001 Q6a P2

(a) (i) Alkali metals

(ii) - Enthalpy change when 1 mole of e-5 is removed from 1 mole of gases atom or

- Energy required to remove radius therefore the outermost electron is MOST STRONGLY attracted to the nucleus, hence more energy is required to removed it.

(most strongly or very strongly in the attraction must be mentioned for a candidate to score 1 mark)

29. 2002 Q1 P1

It is uncreative

30. 2002 Q2 P1

Oxygen exists as discrete molecules (O_2) with only weak van der waal forces between them. While sulphur exists as S_8 rings and chains which are bulky

31. 2002 Q3, 5 P1

A sulphur, carbon, nitrogen

B Sodium potassium, lithium

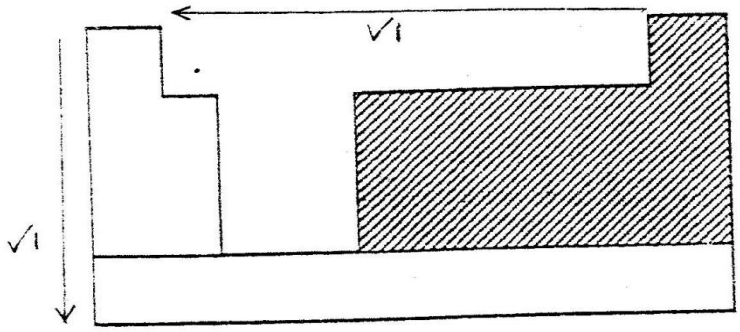
(a) calcium 2.8.8.2

Beryllium 2.2

(b)(i) Both elements are in the same group but the two valence electrons of calcium are further away (1) They are not strongly held by the nucleus, hence are readily released. (1) (3 marks)

32. 2003 Q1a, b (i) P2

a) Non-metals



b) i) KB/KF/KI/KA

33. 2003 Q2 P1

K^+ has three energy levels while Na+ has only two (1)

Mg^{2+} nucleus has 12 protons attracting 10 e-(1) Na+ has 11 protons attracting 10e- hence Mg^{2+} radius shrinks more (1) Or Mg2+ has higher nucleus charge (1) shrinking the ions(1)

34. 2003 Q10 P1

a) +5 / 5

b) 5 / V

35. 2003 Q24 P1

Group 7 elements react by gaining electrons. A small atom has a high e- affinity. This trend decreases down the group.

36. 2004 Q3 P1

The energy required to remove the outermost electron is lower for B than for (1) therefore B is more reactive than (i) (2 marks)

37. 2004 Q16 P1

a) F and J (1 mark)

b) HFJG (2 marks)

38. 2004 Q20 P1

Neutron – proton ratio

Amount of energy released during isotope decay

39. 2004 Q1a P2

(a) (i) Green/ yellow gas

(ii) Slightly soluble/ soluble (Rej highly soluble

(iii) Violet/ purple/ grey/ black solid

40. 2005 Q6 P1

(a) B and F

They are isotopes i.e. atoms of the same element with same mass number but different atomic number

(b) Mass number = Atomic number + No. of neutrons

7 = 3 + n

7 = 3n

N = 4

Cl H

41. 2005 Q16 P1

Increases atomic radius results in decrease of 1^{st} ionization energy

Increasing the radius, decreases the force of attraction from to the outermost electron.

Hence decreasing in the 1^{st} ionization energy down the group.

42. 2005 Q4a, b P1

a) The number 52 represents mass number i.e.: the sum of the number of protons and neutrons in an atom of an element.

N = 20 = 2: 8: 8: 2 p = 17 = 2:8:7

b) i) $N + p_2 \rightarrow Np2$

ii) P,R and S

P is a non – metal while R and S are metals, arranged in the order of S,R and P from left to right form metals (S and R) but increases from left to right for non – metal (p)

iii) S, it is a metal and is the one having the largest atomic radius which decreases from left to right for metal of the same period.

iv) p and u

43. 2006 Q5 P1

a) In solid state - Does not conduct
Ions are fixed (1 ½ marks)

b) Aqueous solution - Conducts

Ions are mobile (1 ½ marks)

44. 2006 Q12 P1

$$\frac{62.93 \times 69.09 + 64.93 \times 30.91}{100}$$

$= 43.4783 + 20.0698$

$= 63.548$ (3 marks).

45. 2007 Q3a, 8

3a) Group (VIII) elements

8. Across the period there is a gradual increase in number of proteins in the nucleus. This increases the force as attracted between the nucleus and the electrons.

46. 2007 Q25b P1

(b) It is less dense and does not burn like hydrogen

47. 2007 Q26 P1

(a) They are both metals and need to lose electrons to be stable

(b) $RCO_3(s) \rightarrow RO(s) + CO_2\ (g)$

(c) Q^{-3}

48. 2008 Q7 P1

(a) Atoms of the same element having different masses or atoms of the Same element having different number of neutrons.

(b) 18- 8 = 10 neutrons

49. 2008 Q11 P1

(a) Ionic/ electrovalent

(b) Has 7 electrons in its outermost energy level and hence easily gains an electron to complete the octet or it is most electronegative.

50. 2008 Q18 P1

(a) Position for silicon

(b) U

51. 2009 Q1 P1

(a) Energy required to remove 1 mole of electrons from 1 mole of gaseous atoms (1 mark)

(b) B (1) 418??? It loses electrons most readily (l)

Reject lowest i.e. $M_g\ (HCO_3)\ 2_{aq} \rightarrow M_gC_S\ O_3 + H_2O + CO_2\ (_g)$

52. 2009 Q3 P1

(i) 2.8.8

(ii) 2.8.2

53. 2009 Q6 P1

60

30^{E+21} wrong/ correct change (- ½)

54. 2010 Q4a P2

a) i) C, copper A,B
B is the most reactive because it has highest ΔT
C is the least reactive because it cannot displace ions of copper from solution. A is more reactive than copper because it displaces Cu^{2+} from solution.
ii)
Blue colour of the solution fades/ disappeared.
Black deposit is formed.

55. 2011 Q5a, b (i-iii) P2

5(a)

- Electron is negatively charged while proton is positively charged
- Electron has a mass of $^1/_{1840}$ units while proton has a mass of 1 unit
- Mass of proton is bigger than that of electron.

5(b)

(i) F
(ii) 27
(iii) E_2G_3 / A_2O_3

56. 2011 Q22 P1

(a) Bromine
(b) -At room temp (25^0c) bromine is solid since its MP and BP is between – 7^0c and 5^0c
-Atomic mass of iodine is higher than that of Cl_2
-Molecular mass

57. 2011 Q24 P1

(a) Y
Y and Z the 2 must be mentioned
(b) They have the same number of protons (8) but different atomic masses/ Mass numbers / number of neutrons

58. 2011 Q31 P1

Alkaline earth metals

59. 2012 Q2 P2

(a) C, √ it has small size/ hence readily attracts electrons to itself. / highest electrons highest tendency to gain electrons. affinity/ smallest to radius / most electronegative electrons (2 marks)
(accept)
(b) (i) AB_2 / CO_2 / AB / CO (1 mark)
(ii) Covalent bond (1 mark)

(c) (i) Halogens √ 1

(ii) C_2 (g) $2H^-$ aq ⟶ H_2 (s) + $2C^-$(aq) (1 mark)

OR

Cl_2 (g) + Br_2 ⟶ $2Cl_3^-$ (aq) + √ Br_2(aq)

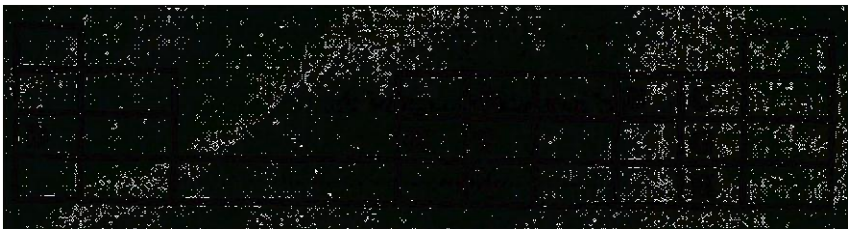
Accept state of H_2 as aq or g.

(d) F - has very strong covalent√ ½ bonds between the atoms with giant atomic√ ½ structure.

G – is made up of atoms √ ½ bonded, covalently. The molecules have weak Vander waals√ ½ forces. Simple molecular structure (2 marks)

(e) D_2O √ ½ OR D_2O_2 √ ½ OR Na_2O OR Na_2O_2 (1 mark)

(f) √ 1 mark



60. 2012 Q4 P1

(a) BDAC - across the period the number of protons / or nuclear charge increases
Or across the period atomic radius decrease

NB: CADB - from right to left atomic radius increases

(b) D.
Across the period conductivity increases due to increase to delocalised/ free electrons

61. 2012 Q14 P1

Ionisation energy – is the energy required to remove an electron from an atom an atom in gaseous

Electron affinity – is the energy change that results in the formation of an ion when an atom gains electron.

62. 2012 Q27 P1

(a) group 5 (or v) (or five)
Period 3 /III/ or three

(b) (i) noble gases / inert gases / rave gases
(ii) in balloons (Helium)
- fluorescence lamps / light bulb
- disco lights
- are welding
- x-ray tubes

- in diluting O_2 gas cylinder, deep sea diving, mountain climbing