ORDINARY LEVEL CHEMISTRY PROBLEMS

PART 4: THE PERIODIC TABLE, ATOMIC STRUCTURE AND BONDING

1. (a) Explain what is meant by the terms
   (i) 'mass number'.
   (ii) 'atomic number'
   (b) An atom of an element is represented by the symbol $^{80}_{35}X$
   (i) State the mass number of the atom.
   (ii) What is the atomic number of the atom?
   (iii) How many neutrons are present in the atom?

2. The positions of the elements A, B, C, D, E and F are shown in the Periodic Table below. These are not the usual symbols for the elements.

I	II	III	IV	V	VI	VII	VIII
A	B				D		
		C				E	F

   (a) State the type of bonding in the compound formed between
   (i) B and D.
   (ii) E and C.
   (b) (i) Which one of the elements A and B reacts vigorously with cold water?
   (ii) Write equation for the reaction between water and the element you have named in (b) (i).

3. The electronic structure of an element X is 2:8:6.
   (a) Write the formula of the most common ion of X.
   (b) To which group of the Periodic Table does X belong?
   (c) Element X reacts with an element M (atomic number=12)
   (i) Write the electronic structure of M.
   (ii) State the type of bond that exists in the compound between M and X.

4. The number of protons and neutrons of atoms A, B, C and D are shown below

Atoms	Number of protons	Number of neutrons
A	6	6
B	12	12
C	6	8
D	17	20

   (a) Which of these atoms are isotopes?Give a reason for your answer.
   (b) Which one of the atoms is of an element in group II of the Periodic Table/ Give a reason for your answer.
   (c) Name the type of bond which is formed when B and D reacts.

5. Part of the Periodic Table indicating the positions of elements W, X and Z is shown below.

I	II	III	IV	V	VI	VII	VIII	I
W		X				Z		W

(a) (i) Write the formula of the oxide of W.
(ii) The oxide of W was dissolved in water.
(iii) Sate whether the resultant solution is acidic, neutral or alkaline. Explain your answer.
(b) Write the formula of the compound formed between X and Z.
(c) Which one of the atoms W, X and Z has the largest atomic radius?

6. The number of electrons' protons and neutrons in atoms A, B, C and D are shown in the table below.

Atom	Electrons	Protons	Neutrons
A	8	8	8
B	16	16	16
C	13	13	14
D	x	3	4

(a) Determine
(i) the value of x
(ii) the approximate relative atomic mass of C.
(b) Write the electronic configurations of the following atoms and ions:
(i) A
(ii) A^{2-}
(iii) C
(iv) C^{3+}
(c) State two atoms that are of elements in the same group of the Periodic Table.

7. The atomic number of element Q is 13.
(a) Write the electronic configuration of an atom of Q.
(b) To which group in the Periodic Table does Q belong?
(c) State whether Q would conduct electricity or not.
(d) (i) Write the formula of the oxide of Q.
(ii) State the type of bonding in the oxide of Q.

8. Part of the Periodic Table is shown below. The letters are not the usual symbols for the elements.

I	II			III	IV	V	VI	VII	VIII
P	Q					S		T	
								U	V
								W	

(a) Which is the least reactive element?
(b) Which one of the elements T, U and W reacts most vigorously with Q?
(c) Write the formula of compound formed between Q and S.
(d) The compound formed between P and W was dissolved in water.
(e) State whether the resultant solution was acidic, basic or neutral.
(f) Which two elements represented in the table can react as reducing agents?

10. Elements X and Y with atomic numbers 12 and 8 respectively react to form a compound W.
(a) Write the electronic configuration of
(i) X.
(ii) Y.
(b) State whether W is

(i) gas, liquid or solid at room temperature.
(ii) covalent or ionic.

11. The atomic numbers of carbon and chlorine are 6 and 17 respectively.
    (a) Draw a diagram to show the electronic structure of
        (i) Carbon.
        (ii) Chlorine.
    (b) Write the structural formula of the compound that can be formed between carbon and chlorine
    (c) Would you expect the compound in (b) to conduct electricity? Give a reason for your answer

12. Part of the Periodic Table showing positions of some elements is shown below. The letters are not the usual symbols of the elements.

I	II		III	IV	V	VI	VII	VIII
A				B				
	E						D	V
E							F	

    (a) State what type of bond in the compound formed between E and F.
    (b) Write the formula of the compound formed between B and D.
    (c) Which one of the elements reacts most vigorously with
        (i) Cold water?
        (ii) Heated zinc?
    (d) Write the formula of the ion formed by C

13. Part of the Periodic Table is shown below.

I	II		III	IV	V	VI	VII	VIII
A								
					C	D		
B	F					E		

    (a) State the type of bonding in the compound formed between
        (i) C and D.
        (ii) E and F.
    (b) (i) Which one of the elements A and B reacts more vigorously with water?
        (ii) Write an equation for the reaction between water and the element you have identified in (i).

14. Figure 1 shows part of the Periodic Table. The letters used are not the correct symbols of the elements.

I	II		III	IV	V	VI	VII	VIII
				P		T	R	
S								Q

    (a) Which of the elements are metals?
    (b) Suppose element P reacts with element T,
        (i) Write the formula of the compound formed between P and T.
        (ii) What would be the type of bond formed between P and T?
    (c) (i) Which element in the table is least reactive?
        (ii) Explain your answer in (c)(i).

(d) (i) Suggest a compound formed between any two elements shown, which would conduct electricity. Give a reason for your answer

15. Use the data in the table below to answer the questions that follow.

Substance	M.P.°C	B.P. °C	Solubility in water	Electrical conductance		Density
				Solid form	Molten form	
A	714	1418	V	None	Good	2.3 g/cm^3
B	-95	56	V	None	None	0.8 g/cm^3
C	1083	2580	I	Good	Good	8.9 g/cm^3
D	-101	-34	V	None	None	2.55 g/l
E	-23	77	I	None	None	1.6 g/cm^3
F	-219	-183	S	None	None	1.33 g/l

V= very soluble; S= slightly soluble; I=insoluble.

(a) (i) Name two substances that are liquid at room temperature.
(ii) Which of the two is more volatile?

(b) Which substance(s) would dissolve in water and could be separated from the solution by
(i) fractional distillation.
(ii) by evaporation of the water?

(c) Which of the substances A to F,
(i) has the structure consisting of ions?
(ii) is a metal?
(iii) is a liquid which would form separate layer with water?
(iv) Would the water be above or below?

(d) Which substance is a gas which
(i) would not be collected efficiently over water.
(ii) would be collected efficiently over water.

16. An atom X of an element, atomic mass 31 contains 15 protons.

(a) (i) State the number of neutrons in X.
(ii) Write the electronic configuration of X.

(b) State the group in the Periodic Table the element belongs.

(c) Write the formula of a compound that can be formed between X and chlorine.

(d) State the bon type in the compound in (c)

(e) An atom Y contains 17 neutrons and 15 protons. What word is used to describe the relationship between X and Y?

17. Part of the Periodic Table is shown below.

I	II				III	IV	V	VI	VII	VIII
						W		V		Z
	Y				T				Q	

(a) State:
(i) The most reactive metal.
(ii) The most reactive –non-metal.
(iii) The atom that forms the largest anion.
(iv) The most non-reactive element.

(b) Write the formula of the compounds formed between the following pairs of elements and in each case state the type of bonding.
(i) W and Q.

(ii) T and Y

18. Some elements in Period 3 of the Periodic Table are shown in the table below.

Group	I	II	III	IV	V	VI	VII	O
Element	E	Y			T	X	Q	Z

(a) Write the formula of the compound formed when
  (i) T reacts with Q.
  (ii) E reacts with X.

(b) State the type of bonding;
  (i) Between the atoms of Y.
  (ii) When X is reacted with oxygen.
  (iii) Between Y and Q.

19. (a) An element X is in Group II of the Periodic Table.
  (i) State the type of bond that exists in the chloride of X.
  (ii) Write the formula of the ion formed by X.

(b) The nitrate of X was strongly heated.
  (i) State what was observed.
  (ii) Write an equation for the reaction

20. An atom of element X contains 15 electrons and 16 neutrons.
(a) (i) State the mass number of X.
  (ii) Write the electronic structure of X.
(b) (i) Write the formula of a chloride of X.
  (ii) State the type of bond that exists in the chloride of X.
(c) Suggest how an aqueous solution of the oxide of X would affect litmus paper

21. (a) The atomic number of the elements M, X and Q are 6,11and 17 respectively.
  (i) Explain what is meant by the term atomic number.
  (ii) Write the electronic structures of Q,M and X.

(b) Q and M can combine with X to form compound
  (i) Use the valency electrons to explain briefly how the atoms M and Q, Q and X form compounds.
  (ii) Write the structural formula of the compounds formed when Q combines with X.

(c) State two properties of the compounds formed between:
  (i) M and X
  (ii) M and Q

22. The number of particles (protons, electrons and neutrons) in atoms; Q, T; W; X and Y are shown in the table below.

Atom	Number of particles		
	Protons	Electrons	Neutrons
Q	1	1	0
T	8	8	8
W	12	12	12
X	16	16	16
Y	1	1	1

(a) State the:

(i) atomic number of Y
(ii) mass number of Q.
(iii) atoms which are isotopes.

(b) Identify the atoms that belong to elements in the same group of the periodic table.

(c) Write the structural formula of the compound that can be formed when Q combines with T.

(d) (i) State one property of the compound formed between T and W.

(ii) Give a reason for your answer in (d) (i) above.

23. The electronic configuration of an atom of element, A , is 2:8:3.

(a) State the group in the Period Table to which A belongs. (01 mark)

(b) Write the:

(i) Electronic configuration of the ion of A. (01 mark)

(ii) Formulae of the oxide and chloride of A. (02 mark)

(c) State the type of bond that exists in the oxide of A. (01 mark)

24. The atomic numbers and the positions of the elements A, B, C, D, E, F, G, H and I in the periodic table are shown below. The letters are not normal symbols of the elements.

I	II						III	IV	V	VI	VII	VIII
A^3								E^6	S		G^9	H^{10}
											U	
				C^{29}			D^{13}			F^{34}	W	I^{36}
B^{37}												

(a) Which one of the elements is a noble (an inert) gas? (1marks)

(b) What name is given to the elements in the group to which G belongs

(c) Which element is likely to:

(i) react more violently with chlorine? (½ mark)

(ii) form colored compound? (½ mark)

(d) Write the formula of the:

(i) Oxide of element D. (01 mark)

(ii) Compound formed between element F and hydrogen. (01 mark)

(e) State the type of bond that would exist in the chloride of element E.

25. (a) (i) Name the three fundamental particles in an atom. (1½ marks)

(ii) With the aid of a labelled diagram, describe how the three particles are located in an atom.

(b) The full symbol of the atom of an element is ${}^{32}_{16}Q$. State what the numbers 16 and 32 stand for.

(c) If the full symbol of another atom is ${}^{34}_{16}R$, state the

(i) similarity and the difference between the atoms Q and R. (01 mark)

(ii) name given to the atoms Q and R. (01 mark)

(d) The atomic numbers of elements W, X and Y are 6, 12 and 17 respectively.

(i) Write the electronic configurations of W, X and Y. (1½ marks)

(ii) Using the outermost shell electrons only, draw a diagram to show how W and Y form aa compound

(iii) State the type of bond formed between X and Y; W and Y. (02 marks)

(iv) Identify the element that exists as a diatomic molecule. (01 mark)

26. The atomic numbers of elements X and Y are 7 and 20 respectively.

(a) Write the electronic configurations of the elements. (2 marks)
(b) State the periods in the Periodic Table to which X and Y belong.
(i) X (1 mark)
(ii) Y
(c) Write the formula of the compound formed X and Y. (1 mark)
(d) State the type of bond in the compound formed in (c). (1 mark)

27. The full symbol of an atom of elements X is $^{27}_{13}X$
(a) (i) State the number of protons in X. (01 mark)
(ii) Write the electronic configuration of X. (01 mark)
(iii) State the group in the Periodic Table to which X belongs. (½ mark)
(b) (i) Write the formula of the oxide of X. (01 mark)
(ii) State the type of bond that exists in the oxide of X. (01 mark)

28. The number of prtons, electrons and neutrons in some particles (ions and atoms) A, B, E, G, H A and F are shown in the table below

	Particles					
	A	B	E	G	H	F
Protons	6	8	13	11	8	17
Electrons	6	8	10	11	8	18
Neutrons	6	8	14	12	10	18

(a) Identify which one of the particles is
(i) An inion
(ii) A cation
(b) State two particles, which are atoms of the same element
(c) State the type of bon formed when particle A combinies with particle H
(d) Write the formula of the ion formed from particle G

29. The atomic numbers of elements Q, R and T are 6, 17 and 19 respectively
(a) Write the elctronic configuration of
(i) Q
(ii) R
(iii) T
(b) R reacted with Q and T to form compounds X and Y resoectively. State the type of bond in compound
(i) X
(ii) Y
(c) İdentify which one of the compounds in (b) would be soluble in
(i) Water
(ii) Petrol

30. The atomic numbers of elements X, Y and Z are 8, 16 and 19 respectively.
(a) State the
(i) Group of the peridic table to which X belongs
(ii) Valency of Y
(iii) Period in the periodic table to which Z belongs
(b) Write the formula of the comound that ca be formed when X reacts with

(i) Y
(ii) Z

(c) State one property of the compound formed between X and Y in which it differes from the compound formed between X and Z

31. The number of electrons, protons and neutrons in the atoms of elements A, B, C, D and E are shown in the table below

Atoms	Electrons	Protons	Neutrons
A	8	8	8
B	13	13	14
C	16	16	16
D	Y	11	11
E	8	Z	10

(a) Determine the values of
(i) Y
(ii) Z

(b) Determine the mass number of atom C

(c) İndicate which atoms
(i) Are isotopes
(ii) Belong to the same group in the periodic table

(d) Write the electronic configuration of
(i) Atom C
(ii) Ion A^{2-}
(iii) Ion B^{3+}

32. Element W contains 14 neutorns and its mass number is 27
(a) Write the electronic configuration of W
(b) Giving reasons, state the group and period of W
(c) (i) Write the formula of the compound formed between W and oxygen
(ii) State the type of bonding that exists in the compound in c (i)

33. The electronic configuration of atoms W, X, Y and Z are 2:4, 2:7, 2:8:3 and 2:8:7 respectively.
(a) Identify the atoms of the elements which are in the same group in the periodic table
(b) Identify the periods to which each atom belongs
(c) Write the formula of the
(i) Ion of X
(ii) The compound formed when
(d) Atom Z reacts with atomsW and Y to form compounds Q and R respectively. Giving a reason state which one of the compounds
(i) Is an electrolyte
(ii) Is insoluble in water

34. Some elements in period 3 of the peiodic table are shown in the table below

Group	I	II	III	IV	V	VI	VII	VIII
Element	P	Q			R	S	T	U

(a) Write the formula of the compound formed when
  (i) R reatcs with T
  (ii) P reacts with S
  (iii) Q reacts with T

(b) State the type of bonding that exist between
  (i) Atoms of Q
  (ii) S and oxygen
  (iii) Q and T

35. The structure of an atom of element Q is $^{23}_{11}Q$

(a) State the number of each of the following in Q
  (i) Protons
  (ii) Neutrons

(b) Write the electronic configuration of Q

(c) With a reason, state the
  (i) Group to which Q belongs
  (ii) Period to which Q belongs

(d) Write the
  (i) Formula of the ion of Q
  (ii) Electronic configuration of the ion of Q

(e) Writhe formula of the formula of the following compounds of Q
  (i) Oxide
  (ii) Sulphate
  (iii) Chloride
  (iv) Phosphate

(f) State the type of bonding in
  (i) Atoms of Q
  (ii) Oxide of Q

36. (a) Distinguish between atomic number and mass number of an atom

(b) Complete the table below showing atoms of elements V, W, X and Y.

Atoms	Neutrons	Mass number	Electronic configuration
$^{37}_{17}V$	.....	.....	.....
$^{13}_{6}W$	.....	.....	.....
$^{---}_{---}X$	12	.....	2: 8: 1
$^{---}_{9}Y$	.....	19	.....

37. (a) Define the following terms
  (i) Isotope
  (ii) Atomic number

(b) Given P, Q, and R with atomic numbers 8, 6, and 4 respectively. Write
  (i) The electronic configuration on each particle
  (ii) The formula of the ion of particle P and R

(c) P can combine with Q and R to form compounds T and V. Using diagrams, show how each of the following compounds is formed
   (i) T
   (ii) V

(d) With a reason, state which one is likely to be a
   (i) A solid at room temperature
   (ii) A molecule

38. (a) Draw a well labelled diagram to show the structure of an atom

(b) Explain how positively and negatively charged ions are formed

(c) The full symbol of two atoms of an element are $^{16}_{8}A$ and $^{18}_{8}B$
   (i) State the group in the periodic table to which the element belongs
   (ii) Determine the number of nuetrons in the atoms A and B
   (iii) State the term used to describe atoms A and B

(d) The atomic numbers of elements D, E and F
   (i) Write the electronic configuration each atom
   (ii) Explain how D form compound with E and F respectively

39. (a) (i) Name the fundamental particles in an atom and in each case state the type of charge on the particle
   (ii) Draw a labeled diagram to show the location of the particle in an atom

(b) The full symbols of atoms of elements Q and R are $^{23}_{11}Q$ and $^{35}_{17}R$ respectively. Write the name and number of particles in the atoms of Q and R

(c) Name the type of bond that would be formed between
   (i) Atoms of Q
   (ii) Atoms of R
   (iii) Atoms of Q and and atom of R

(d) (i) With aid of diagrams, describe how the bonds you have named in (b) are formed
   (ii) State one property of the compound formed between Q and R

40. An element M has electronic structure 2:8:8:2.

(a) State the group to which this element belongs in the Periodic Table.

(b) Element M was put in warm water.
   (i) State what was observed.
   (ii) Write equation for the reaction that took place.

(c) Name **one** use of element M

(d) Write the formula of each of the following compounds of M
   (i) Oxide
   (ii) Nitride
   (iii) Phosphate
   (iv) chloride

41. (a) An element X is in Group II of the Periodic Table.
   (i) State the type of bond that exists in the chloride of X.
   (ii) Write the formula of the ion formed by X.

(b) The nitrate of X was strongly heated.
   (i) State what was observed.
   (ii) Write an equation for the reaction