

(Q1) Describe the contributions of the following scientists to our knowledge of atomic structure:

J. J. Thomson:

R. A. Millikan:

E. Rutherford:

J. Chadwick:

(Q2) Roughly speaking, the radius of an atom is about 10,000 times greater than that of its nucleus. If an atom were magnified so that the radius of its nucleus became 2.0 cm, about the size of a marble, what would be the radius of the atom in miles?

(1 mi = 1609 m).

0.12 mi.

(Q3) What do we call atoms of the same elements with different mass numbers?

Isotopes

(Q4) Calculate the number of neutrons of ^{239}Pu .

Plutonium, atomic number = 94

Number of neutron = $239 - 94 = 145$

(Q5) Indicate the number of protons, neutrons, and electrons in each of the following species:

$^{15}_7\text{N}$: (7 p, 8 n, 7 e)

$^{33}_{16}\text{S}$: (16 p, 17 n, 16 e)

$^{63}_{29}\text{Cu}$: (29 p, 34 n, 29 e)

$^{84}_{38}\text{Sr}$: (38 p, 46 n, 38 e)

$^{130}_{56}\text{Ba}$: (56 p, 74 n, 56 e)

$^{186}_{74}\text{W}$: (74 p, 112 n, 74 e)

$^{202}_{80}\text{Hg}$: (80 p, 122 n, 80 e)

(Q12) Give the number of protons and electrons in each of the following common ions:

K^+ : 19 p, 18 e

Mg^{2+} : 12 p, 10 e

Fe^{3+} : 26 p, 23 e

Br^- : 35 p, 36 e

Mn^{2+} : 25 p, 23 e

C^{4-} : 6 p, 10 e

Cu^{2+} : 29 p, 27 e

(Q13) Give two examples of each of the following:

(a) a diatomic molecule containing atoms of the same element:

H_2 , N_2 , O_2 , Cl_2

(b) a diatomic molecule containing atoms of different elements:

CO , HCl , HF

(c) a polyatomic molecule containing atoms of the same element:

S_8 , P_4

(d) a polyatomic molecule containing atoms of different elements:

H_2O , CO_2 , $C_6H_{12}O_6$

(Q14) What does P_4 signify? How does it differ from $4P$?

(Q15) Write the formulas for the following ionic compounds:

(a) sodium oxide: Na_2O

(b) iron sulfide (containing the Fe^{2+} ion): FeS

(c) cobalt sulfate (containing the Co^{3+} and SO_4^{2-} ions): $Co_2(SO_4)_3$

(d) cobalt sulfate (containing the Co^{2+} and SO_4^{2-} ions): $CoSO_4$

(e) barium fluoride: BaF_2

(f) copper bromide (containing the Cu^+ ion): $CuBr$

(g) manganese oxide (containing the Mn^{3+} ion): Mn_2O_3

(h) mercury iodide (containing the Hg_2^{2+} ion): Hg_2I_2

(i) magnesium phosphate (containing the PO_4^{3-} ion): $Mg_3(PO_4)_2$

(Q16) What are the empirical formulas of the following compounds?

(a) Al_2Br_6 : AlBr_3

(b) $\text{Na}_2\text{S}_2\text{O}_4$: NaSO_2

(c) N_2O_5 : N_2O_5

(d) $\text{K}_2\text{Cr}_2\text{O}_7$: $\text{K}_2\text{Cr}_2\text{O}_7$

(Q17) Which of the following compounds are likely to be ionic? Which are likely to be molecular?

CH_4 : molecular compound

NaBr : ionic compound

BaF_2 : ionic compound

CCl_4 : molecular compound

ICl : molecular compound

CsCl : ionic compound

NF_3 : molecular compound

(Q18) Name these compounds:

(a) KClO : potassium hypochlorite

(b) Ag_2CO_3 : silver carbonate

(c) FeCl_2 : iron (II) chloride

(d) KMnO_4 : potassium permanganate

(e) CsClO_3 : cesium chlorate

(f) HIO : hypoiodous acid

(g) FeO : iron (II) oxide

(h) Fe_2O_3 : iron (III) oxide

(i) TiCl_4 : titanium (IV) chloride

(j) NaH : sodium hydride

(k) Li_3N : lithium nitride

(l) Na_2O : sodium oxide

(m) Na_2O_2 : sodium peroxide (O_2^{2-} , peroxides)

(n) $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$: iron (III) chloride hexahydrate

(Q19) Write the formulas for the following compounds:

- (a) copper(I) cyanide: CuCN
- (b) strontium chlorite: $\text{Sr}(\text{ClO}_2)_2$
- (c) perbromic acid: HBrO_4
- (d) hydroiodic acid: HI
- (e) disodium ammonium phosphate: $\text{Na}_2(\text{NH}_4)\text{PO}_4$
- (f) lead(II) carbonate: PbCO_3
- (g) tin(II) fluoride: SnF_2
- (h) tetraphosphorus decasulfide: P_4S_{10}
- (i) mercury(II) oxide: HgO
- (j) mercury(I) iodide: Hg_2I_2
- (k) selenium hexafluoride: SeF_6

(Q20) Identify the elements represented by the following symbols and give the number of protons and neutrons in each case:

- (a) ${}_{10}^{20}\text{X}$: Ne (10 p & 10 n)
- (b) ${}_{29}^{63}\text{X}$: Cu (29 p & 34 n)
- (c) ${}_{47}^{107}\text{X}$: Ag (47 p & 60 n)
- (d) ${}_{74}^{182}\text{X}$: W (74 p & 108 n)
- (e) ${}_{84}^{203}\text{X}$: Po (84 p & 119 n)
- (f) ${}_{94}^{234}\text{X}$: Pu (94 p & 140 n)

(Q21) Fill in the blanks in the following table:

| | | | | | |
|------------|-----------------------|------------------------------|-----------------------------|--------------------------|--------------------------|
| Symbol | ${}_{5}^{11}\text{B}$ | ${}_{26}^{54}\text{Fe}^{2+}$ | ${}_{15}^{31}\text{P}^{3-}$ | ${}_{79}^{196}\text{Au}$ | ${}_{86}^{222}\text{Rn}$ |
| Protons | 5 | 26 | 15 | 79 | 86 |
| Neutrons | 6 | 28 | 16 | 117 | 136 |
| Electrons | 5 | 24 | 18 | 79 | 86 |
| Net charge | 0 | +2 | -3 | 0 | 0 |

(Q22) Which of the following symbols provides more information about the atom: ${}^{23}\text{Na}$ or ${}_{11}\text{Na}$? Explain.

${}^{23}\text{Na}$

(Q23) List the elements that exist as gases, liquids and solids at room temperature (25°C).

Gases: H₂, N₂, O₂, F₂, Cl₂, He, Ne, Ar, Kr, Xe, Rn

Liquids: Hg, Br

Solids: the rest of the elements

(Q24) Predict the formula and name of a binary compound formed from the following elements:

(a) Na and H: NaH, sodium hydride

(b) B and O: B₂O₃, diboron trioxide

(c) Na and S: Na₂S, sodium sulfide

(d) Al and F: AlF₃, aluminum fluoride

(e) F and O: OF₂, oxygen difluoride

(f) Sr and Cl: SrCl₂, strontium chloride

(Q25) Fill the blanks in the following table.

| Cation | Anion | Formula | Name |
|-------------------------------|-------------------------------|---|------------------------|
| Mg ²⁺ | HCO ₃ ⁻ | Mg(HCO ₃) ₂ | magnesium bicarbonate |
| Sr ²⁺ | Cl ⁻ | SrCl ₂ | strontium chloride |
| Fe ³⁺ | NO ₂ ⁻ | Fe(NO ₂) ₃ | iron(III) nitrite |
| Mn ²⁺ | ClO ₃ ⁻ | Mn(ClO ₃) ₂ | manganese(II) chlorate |
| Sn ⁴⁺ | Br ⁻ | SnBr ₄ | tin(IV) bromide |
| Co ²⁺ | PO ₄ ³⁻ | Co ₃ (PO ₄) ₂ | cobalt(II) phosphate |
| Hg ₂ ²⁺ | I ⁻ | Hg ₂ I ₂ | mercury(I) iodide |
| Cu ⁺ | CO ₃ ²⁻ | Cu ₂ CO ₃ | copper(I) carbonate |
| Li ⁺ | N ³⁻ | Li ₃ N | lithium nitride |
| Al ³⁺ | S ²⁻ | Al ₂ S ₃ | aluminum sulfide |