Solutions to Workbook-1 [Chemistry] | Classification of Elements & Periodicity in Properties

Daily Tutorial Sheet	Level - 0

Very Short Answer Type (1 Mark)

1. 18 Groups and 7 periods

2. He

3. I^{st} period has only two elements – H and He

4. 6^{th} & 7^{th} period. Each contains 32 elements.

5. 2^{nd} & 3^{rd} period. Each contains 8 elements.

6. $\underset{\text{Un}\ \ \text{bi}\ \ \text{nil}}{\overset{120}{\swarrow\ \downarrow\ \searrow}}$ Name $\Rightarrow$ Unbinilium; Symbol $\Rightarrow$ "Ubn"

7. Atomic weight

Short Answer Type-I (2 marks)

8. When elements are arranged in a certain order, a periodic recurrence of their characteristic properties takes place.

9. Properties of an element depend on the outermost shell electronic configuration. The elements belonging to a group have same valence shell electronic configuration and hence similar properties.

10. It is very difficult to study the chemistry of the elements and their compounds individually since their number is very large. Periodic classification of elements makes their study significantly easier.

11. True only for elements upto calcium.

12. Merits

I. He predicted undiscovered elements and also predicted their properties.

II. His arrangement of periodic table helped to correct atomic masses of number of elements.

13. Limitation

I. He was unable to locate hydrogen in periodic table.

II. Increase in atomic mass was not regular while moving from one element to another.

III. Isotopes of element were found which violated his periodic law.

Short Answer Type-II (3 Marks)

14. $\text{moles} = \dfrac{2.3 \times 10^{-3}}{23} = 10^{-4}$ moles

'Na' Atoms $= 10^{-4} \times 6.023 \times 10^{23} = 6.023 \times 10^{19}$

Since for 6.0223×10^{23} Na atoms, energy required $= 495 \times 10^{3}$ J

$\therefore$ For 1 Na atom, energy required $= \dfrac{495 \times 10^{3}}{6.023 \times 10^{23}}$ J

For 6.02×10^{19} Na atom energy required $= \dfrac{495 \times 10^{3}}{6.023 \times 10^{23}} \times 6.023 \times 10^{19} = 495 \times 10^{-1} = 49.5$ J

15. Given I.P. = $13.60\,eV / atom$

I.P. $= 13.60 \times 96.49$ kJ / mole = 1312.264 kJ/mole

No of atoms corresponding to 0.1 mole $H^+ \Rightarrow 6.023 \times 10^{22}$

So for 1 mole atom Ionization energy $= 1312.264\,kJ$

For 6.023×10^{22} atoms $= \dfrac{1312.264 \times 6.023}{6.023 \times 10^{23}} \times 10^{22} = 131.2\,kJ$

16.

$$\begin{array}{ll} He \longrightarrow He^{+} + e^{-} & 24.58\text{ eV} \\ He^{+} \longrightarrow He^{+2} + e^{-} & 54.40\text{ eV} \\ \hline He \longrightarrow He^{+2} + 2e^{-} & E = 78.98\text{ eV / atom} \end{array}$$

$\therefore$ For 1 atom, $E = 78.98 \times 1.6 \times 10^{-19}\,J / atom$

or, $E = 78.98 \times 1.6 \times 10^{-22}\,kJ / atom$

For 1 mole i.e. N_A atoms

$E_{Total} = 78.98 \times 1.6 \times 10^{-22} \times 6.023 \times 10^{23}\,kJ = (761.11 \times 10^{1})\,kJ = 7611\,kJ/mol$

17. No of moles of $Mg(g) = \dfrac{1}{24} = 0.0417$

Energy absorbed in the ionization of $Mg_{(g)} \longrightarrow Mg^{+}{}_{(g)} = 0.0417 \times 740 = 30.83\,kJ$

Energy unused $= 50 - 30.83 = 19.17\,kJ$

$19.17\,kJ$ will be used in the Ionisation of $Mg^{+} \longrightarrow Mg^{2+}{}_{(g)}$

Hence number of mole of $Mg^{+}{}_{(g)}$ converted to $Mg^{2+}{}_{(g)} = \dfrac{19.17}{1450} = 0.0132$

$Mg^{+}{}_{(g)}$ left $= 0.0417 - 0.0132 = 0.0285\,mol$

% of $Mg^{+} = \dfrac{0.0285}{0.0417} \times 100 = 68.35\%$ and % of $Mg^{2+} = 100 - 68.35 = 31.65\%$

18. **(i)** O > N **(ii)** Cl > F **(iii)** S > O **(iv)** Si > C

19. (i) is F (ii) is O (iii) is N (iv) is S

so, correct order of EGE is S > F > O > N

Long Answer Type (5 Marks)

20.

(i)	$1s^2 2s^2 2p^6 3s^2$	Alkaline earth metal
(ii)	$1s^2 2s^2 2p^5$	A halogen
(iii)	$1s^2 2s^2 2p^6 3s^2 3p^2$	Group-14
(iv)	$1s^2 2s^2 2p^6 3s^2 3p^6$	Noble gas
(v)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$	Transition metal
(vi)	$1s^2 2s^2 2p^3$	Group-15

21.

(i)	Li & O	$\Rightarrow$	Li_2O
(ii)	Mg & N	$\Rightarrow$	Mg_3N_2
(iii)	Al & I	$\Rightarrow$	AlI_3
(iv)	Si & O	$\Rightarrow$	SiO_2
(v)	P & F	$\Rightarrow$	PF_3

22. Te, Ra and Po are representative elements.

23. **(i)** Noble gas $\rightarrow$ (e)

(ii) lowest I.P. $\rightarrow$ (b)

(iii) Increasing I.P. (b) < (a) < (c) < (d) < (e)

24. For 35.5 gm Cl, EGE $= -349$ kJ

For 1 gm Cl, EGE $= -\frac{349}{35.5}$

For 3.55 gm Cl, EGE $= \frac{-349}{35.5} \times 3.55 = -34.9\text{kJ}$

25. For 10^{10} atom $Cl(g) + e^- \longrightarrow Cl^-$; Energy released $= 57.86 \times 10^{-10}$ J

For 1atom $\Rightarrow$ Energy released $= 57.86 \times 10^{-10} \times 10^{-10}$ J

Energy released $= 57.86 \times 10^{-20}$ J

For 1 mole i.e. for 6.023×10^{23} atom Energy released $= 57.86 \times 10^{-20} \times 6.023 \times 10^{23}$ J $= 348.49$ kJ / mole

Energy released in eV

$= 57.86 \times N_A / 1.6 \times 10^{-19} = 217.81 \times 10^{22}$ eV