Atomic Structure

DPP-1 Solutions

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1. **18**

Sol. 18; the positive charge denotes the loss of one electron.

2. **(a) $^{37}_{17}Cl^{-}$ (b) 17 (c) 37 (d) 17+ (e) 17**

Sol. Atomic Number = No. of protons = No. of electrons (for neutral atom)

$\therefore$ Atomic Number = 17

p = 17

p + n = 17 + 20 = 37

Cl has an atomic number of 17

(a) $^{37}_{17}Cl^{-}$

(b) Atomic Number = 17 (Already proved above)

(c) Mass Number = 37 (Already proved atove)

(d) Nucleus has protons & nurtrons

$\therefore$ Charge on the nucleus is because of the presence of protons

$\therefore$ Charge on nucleus = + 17

(e) Number of protons = 17 (Already proved above)

3. **(a) 18 electrons, 19 protons, 20 neutrons, (b) electron**

Sol. **(a)** No. of electrons = 19 – 1 = 18

No. of protons = 19

No. neutrons = 39 – 19 = 20

(b) Electron has the smallest mass

4. **(a) 11, (b) 11, (c) 11**

Sol. The answer to each question is 11. These seemingly different questions are all really the same question in different forms.

5.

Sol.

isotopic symbol	atomic number	mass number	number of protons	number neutrons	number electrons	charge
^{15}N	7	15	7	8	7	0
$^{39}K^{+}$	19	39	19	20	18	1+
$^{3}H^{+}$	1	3	1	2	0	1+

6. **107.872**

Sol. Since the old atomic weight of oxygen was 16.0000/15.9994 times as large as the new value, the old atomic weight of silver must be

$(107.868)\left(\frac{16.0000}{15.9994}\right)=107.872$

7. **39.95 u**

Sol. $\frac{0.34}{100}(35.9676)+\frac{0.07}{100}(37.9627)+\frac{99.59}{100}(39.9624)=$ 39.95 u

8. **(a) 5.55m, (b) 3×10^{7} cm, (c) 400Å**

Sol. (a) $\nu = 55\times10^{6}$ Hz.

$\therefore \lambda = \frac{3\times10^{8}}{55\times10^{6}}$ m = 5.55 m **Ans.**

(b) ν = 1000 Hz

$\therefore \lambda = \frac{3\times10^{8}}{10^{3}} = 3\times10^{5}$ m = 3×10^{7} cm **Ans.**

(c) $\nu = 7.5\times10^{15}$ Hz

$\therefore \lambda = \frac{3\times10^{8}}{7.5\times10^{15}} = 4\times10^{-8}$m = 400Å **Ans.**

9. **(i) 1.099×10^{27} electrons**

(ii) 5.48×10^{-7} kg, – 96320C

Sol. **(i)** 9.1×10^{-31} kg is the mass of = 1 electron

10^{-3} kg is the mass of = 1.099×10^{27} electrons

(ii) 1 electron weighs = 9.1×10^{-31} kg

6.02×10^{23} electrons weigh

$= 9.1 \times 10^{-31} \times 6.02 \times 10^{23}$

$= 5.48 \times 10^{-7}$ kg

Charge on 1 electron = -1.6×10^{-19} C

Charge on 6.02×10^{23} electrons

$= -1.6 \times 10^{-19} \times 6.02 \times 10^{23}$

$= -96320$ C

10. **(i) 6.022×10^{24} electrons,**

(ii) (a) 2.4088×10^{21} neutrons

(b) 4.035×10^{-6} kg

(iii) (a) 1.2044×10^{22} protons

(b) 2.015×10^{-5} kg

Sol. **(i)** Methane ≡ CH_4

1 molecule of Methane has = 10 electrons

6.022×10^{23} molecules of methane has = 6.022×10^{24} electrons.

(ii) **(a)** Atomic Number = Number of protons in C = 6

∴ No. of neutrons = 14 – 6

= 8 neutrons.

14g carbon contains

$= 8 \times 6.022 \times 10^{23}$ neutrons

7×10^{-3}g carbon contains

$= 2.4088 \times 10^{21}$ neutrons.

(b) Mass of 1 neutron

$= 1.675 \times 10^{-27}$ kg

Number of neutrons in 7 mg carbon $= 2.4088 \times 10^{21}$ (Calculated in (a))

∴ Mass of neutrons in 7 mg carbon $= 2.4088 \times 10^{21} \times 1.675 \times 10^{-27}$

$= 4.035 \times 10^{-6}$ kg

(iii) **(a)** Total protons in 1 molecule of NH_3 = 10

17g NH_3 has = $10 \times 6.022 \times 10^{23}$ protons

0.034g NH_3 has = 1.2044×10^{22} protons

(b) Mass of 1 proton = 1.67×10^{-27} kg

Total protons in 0.034g NH_3

$= 1.2044 \times 10^{22}$

Mass of protons in 0.034g NH_3

$= 1.2044 \times 10^{22} \times 1.67 \times 10^{-27}$

= 2.011 × 10–5 kg

11. **5×10^9 Hz, 0.06m, 16.66 m^{-1}**

Sol. Frequency, $\nu = \frac{1}{T} = \frac{1}{2 \times 10^{-10}} = 5 \times 10^9 Hz$

$C = \nu\lambda$

Wavelength, $\lambda = \frac{c}{\nu} = \frac{3 \times 10^8}{5 \times 10^9} = 0.06m$

Wave number, $\bar{\nu} = \frac{1}{\lambda} = \frac{1}{0.06} = 16.66 m^{-1}$

12. **(a)**

13. **(c)**

14. **(d)**

Sol. Atomic Number = no. of protons

= 56 – 2 = 54

15. **(a)**

Sol. $\frac{(e/m)_{proton}}{(e/m)_{\alpha-particle}} = \frac{(1/1)}{(2/4)} = \frac{2}{1}$

16. **(a)**

17. **(c)**

18. **(c)**

Sol. Atomic Number of Al = 13

No. of electrons = 13 – 3 = 10

19. **(a)**

Sol. No. of neutrons in each species = 8

20. **(c)**

21. **(b)**