Mole Concept

DPP-1 Solutions

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1.

Sol. ^{12}C. The same standard is used for all atomic, molecular, and formula weights.

2. 78u

Sol. 2 × 23 + 32 = 78u or 78 g/mol

3. 45.0 g

Sol. 1 mol H_2O contains = 18g

2.5 mol H_2O contains = 45g

4. 1.10 mole

Sol. Molecular Mass of Cu $(C_2H_3O_2)_2$ = 181.5 g/mol

181.5g of Cu $(C_2H_3O_2)_2$ contains = 1 mol Cu

200g of Cu $(C_2H_3O_2)_2$ contains = 1.10 mol Cu.

5. 1.20×10^{24} molecules

Sol. 18g water contains = 6.02×10^{23} molecules

36g water contains = 1.20×10^{24} molecules

6. (a) 3 mol Fe, 4 mol O

(b) 1 mol As, 5 mol Cl

(c) 1 mol Mg, 4 mol C, 6 mol H, 4 mol O

(d) 1 mol Cu, 1 mol S, 9 mol O, 10 mol H

Sol. No solution

7. (a) 1 mol Fe and 2 mol S

(b) 8.33 moles Fe = 16.7 mol S

(c) 0.533 kg S

Sol. (a) No solution

(b) Molecular Mass of FeS_2 = 120 g/mol

120g FeS_2 contains = 1 mol Fe

1000g FeS_2 contains = 8.33 moles of Fe

moles of S = 2 × moles of Fe = 16.7 moles

(c) 120g of FeS_2 contains = 64 g S

1000g of FeS_2 contains = $\frac{64}{120} \times 1000$

= 533.33g

= 0.533 kg

8. (a) 1.66×10^{-27}kg/atom

(b) 2.672×10^{-26}kg/atom

(c) 3.9746×10^{-25}kg/atom

Sol. (a) One hydrogen atom weighs = 1.66×10^{-24}g

= 1.66×10^{-27}kg

(b) One oxygen atom weighs = $16 \times 1.66 \times 10^{-24}$

= 2.672×10^{-23}g

= 2.672×10^{-26}kg

(c) One uranium atom weighs = $238 \times 1.66 \times 10^{-24}$

= 3.9746×10^{-22}g

= 3.9746×10^{-25}kg

9. 28.57g Ca

Sol. Molecular Mass of $Ca(NO_3)_2$ = 164g/mol

28g nitrogen is combining with = 40g Ca

20g nitrogen is combining with = 28.57g Ca

10. 0.25 moles

Sol. 6.02×10^{23} atoms of H means 1mol–atoms of hydrogen

So, 4 mol atoms of H are present in

= 1mol $C_2H_4O_2$

1 mol atoms of H are present in

= 0.25 mol $C_2H_4O_2$

11. (a) 0.72g **(b)** 1.44×10^{22} atoms

Sol. (a) Mass of 1 mol $C_6H_{12}O_6$ = 180g

Mass of 4×10^{-3} mol $C_6H_{12}O_6$ = 0.72g

(b) 1 mol $C_6H_{12}O_6$ has = $6 \times 6.02 \times 10^{23}$ atoms of C

4×10^{-3} mol $C_6H_{12}O_6$ has = 1.44×10^{22} atoms of C

12. 5.01×10^{24} atoms

Sol. 12g carbon contains = 6.02×10^{23}atoms

100g carbon contains = 5.01×10^{24} atoms

Yes, Avogadro's No. is a fundamental physical constant

13. (i) 18u, (ii) 44u, (iii) 16u

Sol. (i) (2 × 1) + 16 = 18u

(ii) (12 × 1) + (2 × 16) = 44u

(iii)(12 × 1) + (4 × 1) = 16u

14. (i) 6, (ii) 18, (iii) 1.806×10^{24} molecules

Sol. (i) 1 mol $C_2H_6 \equiv$ 2 mol C atoms

3 mol $C_2H_6 \equiv$ 6 mol C atoms

(ii) 1 mol $C_2H_6 \equiv$ 6 mol H-atoms

3 mol $C_2H_6 \equiv$ 18 mol H-atoms

(iii) 1 mol $C_2H_6 \equiv 6.02 \times 10^{23}$ molecules

3 mol $C_2H_6 \equiv 1.806 \times 10^{24}$ molecules

15. 2.004×10^{-23} g

Sol. One ^{12}C atom weighs = 12 a.m.u

$= 12 \times 1.66 \times 10^{-24}$ g

$= 2.004 \times 10^{-23}$ g

16. **(i) 3.13 × 1025 atoms (ii) 13 atoms**
(iii) 7.826×10^{24} atoms

Sol. **(i)** 1mol Ar ≡ 6.02×10^{23} atoms

52 mol Ar ≡ 3.13×10^{25} atoms

(ii) Atomic mass of He ≡ 4u

4u ≡ 1 atom of He

52u ≡ 13 atoms of He

(iii) Atomic mass of He = 4g/mol

4g ≡ 6.02×10^{23} atoms of He

52g ≡ 7.826×10^{24} atoms of He

17. **(b)**

Sol. 1 amu = 1.66×10^{-24} g,
wt. of one uranium atom = 238 amu
= $238 \times 1.67 \times 10^{-24}$ g = 3.97×10^{-22} g

18. **(a)**

Sol. **(a)** 18g $H_2O \equiv N_A$ molecules

36g $H_2O \equiv 2N_A$ molecules

(b) 44g $CO_2 \equiv N_A$ molecules

28g $CO_2 \equiv 0.63\ N_A$ molecules

(c) 32g $CH_3OH \equiv N_A$ molecues

46g $CH_3OH \equiv 1.4\ N_A$ molecues

(d) 108g $N_2O_5 \equiv N_A$ molecues

58g $N_2O_5 \equiv 0.54\ N_A$ molecues

Hence 36g H_2O has maximum molecues

19. **(c)**

Sol. Mass of 1 molecule of CO_2 = 44 amu
= $44 \times 1.66 \times 10^{-24}$ g = 7.304×10^{-23} g

20. **(b)**

Sol. 4.6×10^{22} atoms weigh = 13.8 g

6.02×10^{23} atoms weigh = 180.6 g

21. **(a)**

Sol. 32g $O_2 \equiv N_A$ molecules

16g $O_2 \equiv 0.5\ N_A$ molecules

28g $N_2 \equiv N_A$ molecules

14g $N_2 \equiv 0.5\ N_A$ molecules

22. **(c)**

Sol. 18g H_2O contains = 1 mol molecules

90g H_2O contains = 5 mol molecules

23. **(b)**

Sol. 17g $NH_3 \equiv 6.02 \times 10^{23}$ molecules

4.25g $NH_3 \equiv 1.505 \times 10^{23}$ molecules

24. **(d)**

Sol. 197g Au ≡ 6.02×10^{23} atoms

19.7×10^3g Au ≡ 6.02×10^{25}

25. **(c)**

Sol. 2g H_2 = 6.02×10^{23} molecules

1g H_2 = 3.0125×10^{23} molecules