Molar Calculations, Part II

1. Choose the false statement.

    [A] 1 mol = 6.02×10^{23} amu   [B] 1 mol of carbon atoms weighs 12.0 g

    [C] Fluorine is a diatomic gas   [D] 6.02×10^{23} atoms = 1 mol of atoms

    [E] 6.02×10^{23} hydrogen atoms weigh 1.008 g

2. One mole of oxygen atoms represents

    [A] 32.0 g   [B] 6.02×10^{23} atoms   [C] 16 atoms   [D] 1.00 g   [E] none of these

3. Which represents the greatest number of atoms?

    [A] 50.0 g Cu   [B] 50.0 g Al   [C] 50.0 g Zn   [D] 50.0 g Fe   [E] all the same

4. Which represents the greatest mass?

    [A] 1.0 mol Fe   [B] 1.0 mol Zn   [C] 1.0 mol Cu

    [D] 1.0 mol Al   [E] all the same

5. How many atoms of calcium are present in 80.0 g of calcium?

    [A] 3.32×10^{-24} [B] 2   [C] 6.02×10^{23} [D] 1.20×10^{24} [E] none of these

6. Calculate the molar mass of a sample if a single molecule weighs 5.34×10^{-23} g.

    [A] 32.2 g/mol   [B] 5.34×10^{-23} g/mol   [C] 12.0 g/mol

    [D] 1.13×10^{46} g/mol   [E] none of these

7. A chemical mole

    [A] is a large molecule   [B] contains 6.02×10^{23} particles

    [C] is no longer useful to chemistry   [D] was a kind of material

    [E] contains an undetermined number of ions

8. What is the mass of one atom of copper in grams?

    [A] 1.06×10^{-22} g   [B] 58.9 g   [C] 63.5 g   [D] 52.0 g   [E] 65.4 g

9. Calculate the mass of 20.0 moles of He.

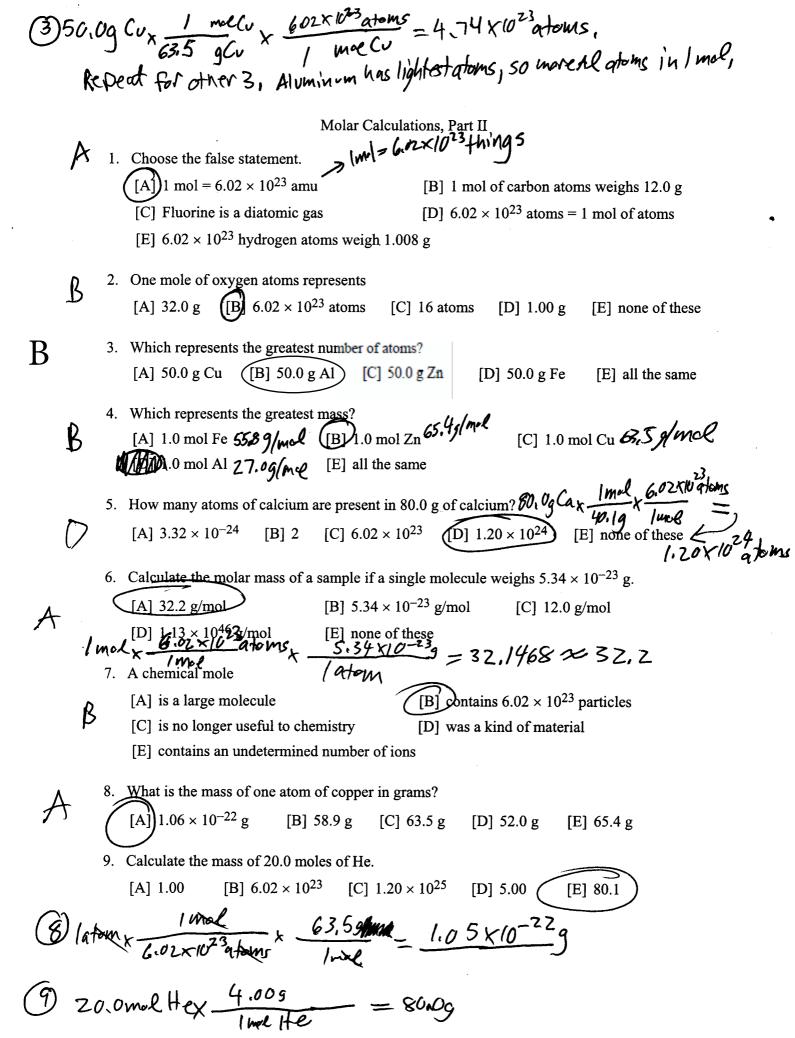   [A] 1.00   [B] 6.02×10^{23} [C] 1.20×10^{25} [D] 5.00   [E] 80.1

Molar Calculations, Part II

10. How many atoms are there in 58.7 g of nickel?

   [A] 28   [B] 1   [C] 6.02×10^{23} [D] 1.204×10^{23} [E] none of these

11. One mole of water weighs

   [A] 18 mL   [B] 3 g   [C] 1 g   [D] 10 g   [E] 18 g

12. A 20.0-g sample of Ca contains how many calcium atoms?

   [A] 6.02×10^{23} atoms   [B] 40.1 atoms   [C] 0.500 atoms

   [D] 20.0 atoms   [E] 3.0×10^{23} atoms

13. 0.314 mol of a diatomic molecule has a mass of 22.26 g. Identify the molecule.

   [A] I_2 [B] F_2 [C] Br_2 [D] Cl_2 [E] none of these

14. 18.7 kg of Zn represents how many grams?

15. 18.7 kg of Zn represents how many milligrams?

16. 18.7 kg of Zn represents how many moles?

17. What is the molar mass of nitroglycerin, $C_3H_5(NO_3)_3$?

   [A] 199 g/mol   [B] 165 g/mol   [C] 309 g/mol

   [D] 227 g/mol   [E] none of these

18. How many molecules of O_2 are there in 4.0 mol of O_2

   [A] 2.4×10^{24} [B] 64   [C] 128   [D] 6.6×10^{-24} [E] 1.9×10^{25}

19. Calculate the mass of 9.13×10^{19} molecules of HCl.

20. 6.00 g of water contains how many molecules of water?

   [A] 3.00   [B] 0.333   [C] 4.20×10^{23} [D] 3.61×10^{24} [E] 2.10×10^{23}

③ $50.0 \text{g Cu} \times \dfrac{1 \text{ mol Cu}}{63.5 \text{ gCu}} \times \dfrac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol Cu}} = 4.74 \times 10^{23} \text{ atoms.}$

Repeat for other 3. Aluminum has lightest atoms, so more Al atoms in 1 mol.

Molar Calculations, Part II

→ $1 \text{ mol} = 6.02 \times 10^{23} \text{ things}$

A 1. Choose the false statement.

[A] 1 mol = 6.02×10^{23} amu   [B] 1 mol of carbon atoms weighs 12.0 g

[C] Fluorine is a diatomic gas   [D] 6.02×10^{23} atoms = 1 mol of atoms

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B 2. One mole of oxygen atoms represents

[A] 32.0 g   [B] 6.02×10^{23} atoms   [C] 16 atoms   [D] 1.00 g   [E] none of these

B 3. Which represents the greatest number of atoms?

[A] 50.0 g Cu   [B] 50.0 g Al   [C] 50.0 g Zn   [D] 50.0 g Fe   [E] all the same

B 4. Which represents the greatest mass?

[A] 1.0 mol Fe 55.8 g/mol [B] 1.0 mol Zn 65.4 g/mol [C] 1.0 mol Cu 63.5 g/mol

[D] 1.0 mol Al 27.0 g/mol [E] all the same

D 5. How many atoms of calcium are present in 80.0 g of calcium? $80.0 \text{ g Ca} \times \dfrac{1 \text{ mol}}{40.1 \text{ g}} \times \dfrac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} =$

[A] 3.32×10^{-24} [B] 2   [C] 6.02×10^{23} [D] 1.20×10^{24} [E] none of these $1.20 \times 10^{24} \text{ atoms}$

A 6. Calculate the molar mass of a sample if a single molecule weighs 5.34×10^{-23} g.

[A] 32.2 g/mol   [B] 5.34×10^{-23} g/mol   [C] 12.0 g/mol

[D] 1.13×10^{46} g/mol   [E] none of these

$1 \text{ mol} \times \dfrac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \times \dfrac{5.34 \times 10^{-23} \text{ g}}{1 \text{ atom}} = 32.1468 \approx 32.2$

B 7. A chemical mole

[A] is a large molecule   [B] contains 6.02×10^{23} particles

[C] is no longer useful to chemistry   [D] was a kind of material

[E] contains an undetermined number of ions

A 8. What is the mass of one atom of copper in grams?

[A] 1.06×10^{-22} g   [B] 58.9 g   [C] 63.5 g   [D] 52.0 g   [E] 65.4 g

9. Calculate the mass of 20.0 moles of He.

[A] 1.00   [B] 6.02×10^{23} [C] 1.20×10^{25} [D] 5.00   [E] 80.1

⑧ $1 \text{ atom} \times \dfrac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \times \dfrac{63.5 \text{ g}}{1 \text{ mol}} = 1.05 \times 10^{-22} \text{ g}$

⑨ $20.0 \text{ mol He} \times \dfrac{4.00 \text{ g}}{1 \text{ mol He}} = 80.0 \text{ g}$

(10) $58.7g \, Ni \times \dfrac{1 \, mol}{58.7g} \times \dfrac{6.02 \times 10^{23} \, atoms}{1 \, mole} = \underline{6.02 \times 10^{23}} \, atoms$

Molar Calculations, Part II

C 10. How many atoms are there in 58.7 g of nickel?

   [A] 28 [B] 1 (C) 6.02×10^{23} [D] 1.204×10^{23} [E] none of these

E 11. One mole of water weighs $H+H+O = 1+1+6 = 18 \, g/mol = 18 \, grams \, per \, 1 \, mole$

   [A] 18 mL [B] 3 g [C] 1 g [D] 10 g ([E] 18 g)

E 12. A 20.0-g sample of Ca contains how many calcium atoms?

   [A] 6.02×10^{23} atoms [B] 40.1 atoms [C] 0.500 atoms
   [D] 20.0 atoms ([E]) 3.0×10^{23} atoms $20.0g \times \dfrac{1 \, mol}{40.1g} \times \dfrac{6.02 \times 10^{23} \, atoms}{1 \, mole} = 3.00 \times 10^{23}$

D 13. 0.314 mol of a diatomic molecule has a mass of 22.26 g. Identify the molecule.

   [A] I_2 [B] F_2 [C] Br_2 (D) Cl_2 [E] none of these

   $molar \, mass = \#g \div \#mol = \dfrac{22.26g}{0.314 \, mole} = 70.9 g/mol \quad Cl_2 = 30.5 + 30.5 = 71 g/mol$

14. 18.7 kg of Zn represents how many grams?

   $18.7 kg \times \dfrac{1000g}{1 kg} = \dfrac{18700g}{} = 1.87 \times 10^4 g$

15. 18.7 kg of Zn represents how many milligrams?

   $18.7 kg \times \dfrac{10^3 g}{1 kg} \times \dfrac{10^3 mg}{1g} = \underline{1.87 \times 10^7} mg$

16. 18.7 kg of Zn represents how many moles?

   $18.7 kg \times \dfrac{1000g}{1 kg} \times \dfrac{1 \, mol}{65.4g} = \underline{286} \, mol$

   $(3 \times C) + (5 \times H) + (9 \times O) + (3 \times N)$

17. What is the molar mass of nitroglycerin, $C_3H_5(NO_3)_3$?

D [A] 199 g/mol [B] 165 g/mol [C] 309 g/mol $= 36$
   (D) 227 g/mol [E] none of these

   $\begin{array}{r} 36 \\ 5 \\ 144 \\ + 42 \\ \hline 227 \end{array}$ (227)

18. How many molecules of O_2 are there in 4.0 mol of O_2

A ([A]) 2.4×10^{24} [B] 64 [C] 128 [D] 6.6×10^{-24} [E] 1.9×10^{25}

19. Calculate the mass of 9.13×10^{19} molecules of HCl.

   $9.13 \times 10^{19} \, molecules \times \dfrac{1 \, mol}{6.02 \times 10^{23} \, molecules} \times \dfrac{36.5g}{1 \, mol} = (5.54 \times 10^{-3} g)$

E 20. 6.00 g of water contains how many molecules of water?

   [A] 3.00 [B] 0.333 [C] 4.20×10^{23} [D] 3.61×10^{24} (E) 2.10×10^{23}

   $\searrow 2.10?$

(18) $4.0 \, mol \, O_2 \times \dfrac{6.02 \times 10^{23} \, molecules \, O_2}{1 \, mole \, O_2} = 2.41 \times 10^{24} \, molecules$

(20) $6.00g \, H_2O \times \dfrac{1 \, mol}{18.0g \, H_2O} \times \dfrac{6.02 \times 10^{23} \, molecules}{1 \, mol} = \underline{2.01 \times 10^{23}} \, molecules$