

Whack-A-Mole

Simulation: edtechsims.com/whack-a-mole

Name: _____ Class: _____ Date: _____



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Data

Useful data	
Ar: H = 1, He = 4, C = 12, N = 14, O = 16, Na = 23, Mg = 24, S = 32, Cl = 35.5, Ar = 40	
Avogadro constant = 6.02×10^{23} /mol 1 dm ³ = 1000 cm ³	Molar gas volume = 24 dm ³ (24 000 cm ³) at r.t.p.

Part A: The Four Formulas

On the sim: Read How to play and the Formulas box on the home page. Then complete the formulas below.

A1 Complete the formula for each category in the game. [4]

Category	Formula for number of moles, n
Mass ↔ mole	n =
Particles ↔ mole	n =
Volume ↔ mole	n =
Concentration ↔ mole	n =

A2 Before using the Volume or Concentration formula, what must you do to a volume given in cm³? [1]

.....

Part B: Mass ↔ Mole

On the sim: Play Practice mode with only Mass ↔ mole selected. Then complete Table 1.

B1 Complete Table 1. Use the Ar values in the Data box.

[10]

Substance	Mr	Mass / g	Amount / mol
H ₂ O		36	
CO ₂		11	
NaCl		117	
Mg		6.0	
SO ₂		32	
MgO			0.50
NaOH		10	
H ₂ SO ₄			0.10
HCl		73	
CO			0.50

Table 1

Part C: Particles ↔ Mole

On the sim: Play Practice mode with only Particles ↔ mole selected. Then complete Table 2.

C1 Complete Table 2.

[5]

Particles	Number of particles	Amount / mol
Na atoms	3.01×10^{23}	
H ₂ O molecules	1.204×10^{24}	
CO ₂ molecules		0.25
He atoms		0.10
N ₂ molecules	9.03×10^{23}	

Table 2

C2 0.50 mol of NH₃ contains how many molecules and how many atoms?

[2]

molecules = ... atoms = ...

Part D: Volume ↔ Mole

On the sim: Play Practice mode with only Volume ↔ mole selected. Then complete Table 3. All gases are at r.t.p.

D1 Complete Table 3.

[5]

Gas	Volume	Amount / mol
CO ₂	48 dm ³	
O ₂	12 dm ³	
N ₂		0.25
H ₂	240 cm ³	
Ar		0.10

Table 3

D2 A student says that 1 mol of water has a volume of 24 dm³ at r.t.p. Explain the mistake.

[1]

.....

Part E: Concentration ↔ Mole

On the sim: Play Practice mode with only Concentration ↔ mole selected. Then complete Table 4.

E1 Complete Table 4.

[4]

Concentration / (mol/dm ³)	Volume of solution	Amount of solute / mol
2.0	500 cm ³	
0.10	250 cm ³	
	250 cm ³	0.50
0.20		0.050

Table 4

Part F: Game Record

On the sim: Play Timed mode (2 min or 5 min) with all four categories selected. Remember: a wrong whack costs –15 points and resets your combo.

Game	Mode	Categories	Score	Best combo
1				
2				
3				

F1 Look at "Moles you missed" on the results page. Choose one and show the working that proves its number of moles. [2]

.....

.....

Part G: Practice Questions

G1 Whack the 1 mol! Circle every card that contains exactly 1 mol of the substance named. [7]

18 g of H ₂ O	1 g of H ₂	6.02×10^{23} atoms of He
24 dm ³ of O ₂ at r.t.p.	16 g of O ₂	3.01×10^{23} molecules of CO ₂
500 cm ³ of 2.0 mol/dm ³ HCl	58.5 g of NaCl	24 dm ³ of liquid water
44 g of CO ₂	35.5 g of Cl ₂	40 g of NaOH

G2 Magnesium reacts with excess hydrochloric acid: $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

(a) Calculate the number of moles in 0.48 g of magnesium. [1]

moles = ... mol

(b) Calculate the volume of hydrogen produced at r.t.p., in cm³. [2]

volume = ... cm³

(c) Calculate the number of hydrogen molecules produced. [1]

molecules = ...

G3 4.0 g of sodium hydroxide is dissolved in water and made up to 250 cm³. Calculate the concentration in mol/dm³ and in g/dm³. [3]

..... mol/dm³ g/dm³

Answer Key: Mole Mash

Data

Useful data	
Ar: H = 1, He = 4, C = 12, N = 14, O = 16, Na = 23, Mg = 24, S = 32, Cl = 35.5, Ar = 40	
Avogadro constant = 6.02×10^{23} /mol	Molar gas volume = 24 dm ³ (24 000 cm ³) at r.t.p.
1 dm ³ = 1000 cm ³	

Part A: The Four Formulas

On the sim: Read How to play and the Formulas box on the home page. Then complete the formulas below.

A1 Complete the formula for each category in the game. [4]

Category	Formula for number of moles, n
Mass ↔ mole	$n = \text{mass (g)} \div M_r$
Particles ↔ mole	$n = \text{number of particles} \div 6.02 \times 10^{23}$
Volume ↔ mole	$n = \text{volume (dm}^3\text{)} \div 24$ (gases at r.t.p. only)
Concentration ↔ mole	$n = \text{concentration (mol/dm}^3\text{)} \times \text{volume (dm}^3\text{)}$

A2 Before using the Volume or Concentration formula, what must you do to a volume given in cm³? [1]

Divide by 1000 to convert it to dm³.

Part B: Mass ↔ Mole

On the sim: Play Practice mode with only Mass ↔ mole selected. Then complete Table 1.

B1 Complete Table 1. Use the Ar values in the Data box. [10]

Substance	M_r	Mass / g	Amount / mol
H ₂ O	18	36	2.0
CO ₂	44	11	0.25
NaCl	58.5	117	2.0
Mg	24	6.0	0.25
SO ₂	64	32	0.50
MgO	40	20	0.50
NaOH	40	10	0.25
H ₂ SO ₄	98	9.8	0.10
HCl	36.5	73	2.0
CO	28	14	0.50

Table 1

Part C: Particles ↔ Mole

On the sim: Play Practice mode with only Particles ↔ mole selected. Then complete Table 2.

C1 Complete Table 2.

[5]

Particles	Number of particles	Amount / mol
Na atoms	3.01×10^{23}	0.50
H ₂ O molecules	1.204×10^{24}	2.0
CO ₂ molecules	1.505×10^{23}	0.25
He atoms	6.02×10^{22}	0.10
N ₂ molecules	9.03×10^{23}	1.5

Table 2

C2 0.50 mol of NH₃ contains how many molecules and how many atoms?

[2]

Molecules = $0.50 \times 6.02 \times 10^{23} = 3.01 \times 10^{23}$. Each NH₃ has 4 atoms, so atoms = 1.204×10^{24} .

Part D: Volume ↔ Mole

On the sim: Play Practice mode with only Volume ↔ mole selected. Then complete Table 3. All gases are at r.t.p.

D1 Complete Table 3.

[5]

Gas	Volume	Amount / mol
CO ₂	48 dm ³	2.0
O ₂	12 dm ³	0.50
N ₂	6.0 dm ³	0.25
H ₂	240 cm ³	0.010
Ar	2 400 cm ³	0.10

Table 3

D2 A student says that 1 mol of water has a volume of 24 dm³ at r.t.p. Explain the mistake.

[1]

24 dm³ is the molar volume of a gas only; water is a liquid at r.t.p. (1 mol is only about 18 cm³).

Part E: Concentration ↔ Mole

On the sim: Play Practice mode with only Concentration ↔ mole selected. Then complete Table 4.

E1 Complete Table 4.

[4]

Concentration / (mol/dm ³)	Volume of solution	Amount of solute / mol
2.0	500 cm ³	1.0
0.10	250 cm ³	0.025
2.0	250 cm ³	0.50
0.20	250 cm ³	0.050

Table 4

Part F: Game Record

On the sim: Play Timed mode (2 min or 5 min) with all four categories selected. Remember: a wrong whack costs –15 points and resets your combo.

Game	Mode	Categories	Score	Best combo
1				
2				
3				

F1 Look at "Moles you missed" on the results page. Choose one and show the working that proves its number of moles. [2]

Open response; the working must use the correct formula from Part A.

Part G: Practice Questions

G1 Whack the 1 mol! Circle every card that contains exactly 1 mol of the substance named. [7]

18 g of H ₂ O	1 g of H ₂	6.02×10^{23} atoms of He
24 dm ³ of O ₂ at r.t.p.	16 g of O ₂	3.01×10^{23} molecules of CO ₂
500 cm ³ of 2.0 mol/dm ³ HCl	58.5 g of NaCl	24 dm ³ of liquid water
44 g of CO ₂	35.5 g of Cl ₂	40 g of NaOH

1 mol: 18 g H₂O, 6.02×10^{23} He atoms, 24 dm³ O₂, 500 cm³ of 2.0 mol/dm³ HCl, 58.5 g NaCl, 44 g CO₂, 40 g NaOH. Not 1 mol: 1 g H₂ (0.5), 16 g O₂ (0.5), 3.01×10^{23} CO₂ (0.5), 35.5 g Cl₂ (0.5), liquid water (24 dm³ rule does not apply).

G2 Magnesium reacts with excess hydrochloric acid: $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

(a) Calculate the number of moles in 0.48 g of magnesium. [1]

$$0.48 \div 24 = 0.020 \text{ mol}$$

(b) Calculate the volume of hydrogen produced at r.t.p., in cm³. [2]

$$n(\text{H}_2) = 0.020 \text{ mol}; 0.020 \times 24\,000 = 480 \text{ cm}^3$$

(c) Calculate the number of hydrogen molecules produced. [1]

$$0.020 \times 6.02 \times 10^{23} = 1.204 \times 10^{22} \text{ molecules}$$

G3 4.0 g of sodium hydroxide is dissolved in water and made up to 250 cm³. Calculate the concentration in mol/dm³ and in g/dm³. [3]

$$n = 4.0 \div 40 = 0.10 \text{ mol}; c = 0.10 \div 0.250 = 0.40 \text{ mol/dm}^3; 0.40 \times 40 = 16 \text{ g/dm}^3$$