1 Experiment Circus

Here are 10 simple questions involving measurements to get students accustomed to using the mole concept in different contexts. Select the most appropriate experiments for the class.

Remember to complete a risk assessment before beginning practical work.

Set up an experiment on each desk.
Split the class into groups of 3.
Set a time limit for each task.

A

Equipment
Empty drink can made of aluminium, balance, calculator

Question
How many atoms of aluminium are in the can?
What assumptions have you made in your answer?

B

Equipment
50p coin, balance, calculator

Question
The 50p coin is 75% copper and 25% nickel by mass. How much copper and zinc (in mol) is there in the coin?
How many atoms of each do you have?

C

Equipment
Aluminium foil, balance, ruler, calculator

Question
What does 1 atom of aluminium cost?

The sample you have been given came from a roll of aluminium of dimensions 300 mm x 10m and cost £1.84.

D

Equipment
Stopwatch, calculator

Question
How long would it take you to count up to Avogadro's number, starting now?

Calculate in seconds, hours, days, years, centuries and millennia.

E

Equipment
Balance, citric acid ($C_6H_8O_7$), sodium bicarbonate ($NaHCO_3$), calcium carbonate ($CaCO_3$), tartaric acid ($C_4H_6O_6$), periodic table.

Challenge
Measure out samples of each of the substances you have so that you have four piles, each containing the same number of molecules.

F

Equipment
Balance, aluminium, copper, carbon, periodic table

Challenge
You have been provided with a sample of copper. Measure the same number of Al atoms out. Then carbon.

G

Equipment
Calculator, periodic table

Question
Somebody left the note "I love Avogadro" lying in the lab. How many atoms of carbon (from the graphite pencil) are on the piece of paper?

Mass of paper = 2.48652 g
Mass of paper + pencil = 2.49428 g

H

Equipment
Measuring tapes, calculator

Question
How much gas is present in this room (in mol). Is the true answer likely to be more or less than your estimation? Why?
What volume of oxygen is there in this room?
At 298K , one mol of any gas occupies 24 dm^3. 21% of air is oxygen.

I

Equipment
Plastic drink bottle, balloon, sodium bicarbonate, vinegar

Challenge
Pour 100 cm^3 vinegar into a plastic drink bottle. Place 8 g sodium bicarbonate into a balloon. Attach the balloon to the neck of the bottle (you are going to collect the gas). Estimate how much gas has been produced in your experiment.
Does this agree with what the equation predicts (sodium bicarbonate is the limiting reagent)?
Identify sources of error.
$NaHCO_3 + CH_3COOH \rightarrow CO_2 + H_2O + NaCH_3COO$

J

Equipment
Calculator, 100 cm^3 volumetric flask, NaCl, balance, periodic table

Challenge
A 1 M solution is a solution that contains 1 mole of substance per dm^3 of solvent.
Make up 100 cm^3 of a 1 M solution of NaCl. How much NaCl did you have to put in?