

INKPHYSICS FLASHCARDS

Measurements

Year 12 · 35 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in mark-scheme wording, the equations that are not on the AQA data sheet, each lesson's check question, and the misconceptions that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/physics/flashcards.

RECALL

State the SI base quantities.

SI UNITS AND PREFIXES

RECALL

State the SI base units.

SI UNITS AND PREFIXES

RECALL

State the value of the prefix centi.

SI UNITS AND PREFIXES

RECALL

State the conversion between electronvolts and joules.

SI UNITS AND PREFIXES

RECALL

State the conversion between kilowatt hours and joules.

SI UNITS AND PREFIXES

RECALL

Explain how to convert a squared unit that carries a prefix.

SI UNITS AND PREFIXES

DEFINITION

Define: Homogeneous equation.

SI UNITS AND PREFIXES

RECALL

State how to check an equation for homogeneity.

SI UNITS AND PREFIXES

RECALL

The units of the six base quantities: the kilogram (kg), metre (m), second (s), ampere (A), kelvin (K) and mole (mol).

SI UNITS AND PREFIXES

RECALL

The base quantities used at A-level: mass, length, time, electric current, temperature and amount of substance. (SI has a seventh: luminous intensity.)

SI UNITS AND PREFIXES

RECALL

$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$, the energy an electron gains crossing a potential difference of one volt.

SI UNITS AND PREFIXES

RECALL

Centi (c) multiplies a unit by 10^{-2} , the only required prefix that is not a power of a thousand.

SI UNITS AND PREFIXES

RECALL

The prefix is squared along with the unit: $1 \text{ mm}^2 = (10^{-3} \text{ m})^2 = 10^{-6} \text{ m}^2$.

SI UNITS AND PREFIXES

RECALL

$1 \text{ kW h} = 3.6 \times 10^6 \text{ J}$, because 1000 W is delivered for 3600 s.

SI UNITS AND PREFIXES

RECALL

Replace every symbol by its SI base units, collect and cancel the powers, then compare the two sides and every term that is added to another.

SI UNITS AND PREFIXES

DEFINITION

An equation in which every term, on both sides, has the same SI base units.

SI UNITS AND PREFIXES

RECALL

Explain what a failed homogeneity check proves, and what a passed one does not.

SI UNITS AND PREFIXES

RECALL

State the convention for labelling a table column or a graph axis.

SI UNITS AND PREFIXES

RECALL

State the SI base quantity whose base unit is the mole.

SI UNITS AND PREFIXES

SPOT THE ERROR

Say what is wrong with this claim:

Units are labels you attach once the number is finished.

SI UNITS AND PREFIXES

DEFINITION

Define: Accuracy.

UNCERTAINTY AND ERROR

DEFINITION

Define: Precision.

UNCERTAINTY AND ERROR

RECALL

Explain how precision and accuracy differ.

UNCERTAINTY AND ERROR

DEFINITION

Define: Repeatability.

UNCERTAINTY AND ERROR

RECALL

Write the quantity divided by its unit, as in speed / m s^{-1} , so that the entries below it are pure numbers and no unit is repeated against them.

SI UNITS AND PREFIXES

RECALL

A mismatch proves the equation is wrong. A match does not prove it right, because a missing pure number such as $\frac{1}{2}$ or 2π leaves the base units untouched.

SI UNITS AND PREFIXES

SPOT THE ERROR

Units are part of the physics, not labels added afterwards. Carry them through the calculation to check the algebra; an answer with the wrong unit is wrong.

SI UNITS AND PREFIXES

RECALL

Amount of substance, which is an SI base quantity in its own right, on the same footing as mass and length.

SI UNITS AND PREFIXES

DEFINITION

How closely repeated readings cluster together.

UNCERTAINTY AND ERROR

DEFINITION

How close a result is to the true value.

UNCERTAINTY AND ERROR

DEFINITION

The same experimenter, using the same method and equipment, obtains consistent results.

UNCERTAINTY AND ERROR

RECALL

A precise result need not be accurate: readings can cluster tightly about a value offset from the true value.

UNCERTAINTY AND ERROR

DEFINITION

Define: Reproducibility.

UNCERTAINTY AND ERROR

DEFINITION

Define: Resolution.

UNCERTAINTY AND ERROR

DEFINITION

Define: Uncertainty.

UNCERTAINTY AND ERROR

DEFINITION

Define: Random error.

UNCERTAINTY AND ERROR

RECALL

Explain how random error is reduced.

UNCERTAINTY AND ERROR

DEFINITION

Define: Systematic error.

UNCERTAINTY AND ERROR

RECALL

Explain why repeating readings does not reduce a systematic error.

UNCERTAINTY AND ERROR

RECALL

State how to combine uncertainties when adding or subtracting.

UNCERTAINTY AND ERROR

DEFINITION

The smallest change in a quantity that an instrument can display.

UNCERTAINTY AND ERROR

DEFINITION

A different experimenter, or a different method or equipment, still obtains consistent results.

UNCERTAINTY AND ERROR

DEFINITION

Error that scatters readings unpredictably either side of the true value.

UNCERTAINTY AND ERROR

DEFINITION

The interval within which the true value can reasonably be expected to lie, quoted after a $\pm$ sign.

UNCERTAINTY AND ERROR

DEFINITION

Error that shifts every reading the same way, such as a zero error.

UNCERTAINTY AND ERROR

RECALL

Random error is reduced by taking repeat readings and averaging, because the scatter partly cancels.

UNCERTAINTY AND ERROR

RECALL

Add the absolute uncertainties of the quantities.

UNCERTAINTY AND ERROR

RECALL

Repeating and averaging does not reduce a systematic error, because every reading is shifted the same way.

UNCERTAINTY AND ERROR

RECALL

State how to combine uncertainties when multiplying or dividing.

UNCERTAINTY AND ERROR

RECALL

State how to find the uncertainty of a quantity raised to a power n .

UNCERTAINTY AND ERROR

RECALL

State how to find the uncertainty of a mean from repeated readings.

UNCERTAINTY AND ERROR

EQUATION · NOT ON THE AQA DATA SHEET

Percentage uncertainty:

percentage uncertainty = ?

UNCERTAINTY AND ERROR

SPOT THE ERROR

Say what is wrong with this claim:

A measurement is a number.

UNCERTAINTY AND ERROR

DEFINITION

Define: Order of magnitude.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

State where the crossover between adjacent orders of magnitude falls.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

State what "differ by n orders of magnitude" means.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

Multiply the percentage uncertainty by n.

UNCERTAINTY AND ERROR

RECALL

Add the percentage uncertainties of the quantities.

UNCERTAINTY AND ERROR

EQUATION · NOT ON THE AQA DATA SHEET

**percentage uncertainty =
(uncertainty)/(value) × 100**

UNCERTAINTY AND ERROR

RECALL

Half the range: subtract the smallest reading from the largest and halve the result.

UNCERTAINTY AND ERROR

DEFINITION

A value expressed to the nearest power of ten.

ESTIMATION AND ORDERS OF MAGNITUDE

SPOT THE ERROR

A number alone is not a measurement. A measurement is a value, a unit and an uncertainty, because every instrument has finite resolution and every method has scatter.

UNCERTAINTY AND ERROR

RECALL

One quantity is about 10^n times the other.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

Values compare by ratio, so the boundary is $\sqrt{10} \approx 3.2$: anything above about 3.2×10^n rounds to 10^{n+1} .

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

State the benchmark density of water.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

State the benchmark density of air.

ESTIMATION AND ORDERS OF MAGNITUDE

SPOT THE ERROR

Say what is wrong with this claim:

If it came out of the calculator, it must be right.

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

About 1.2 kg m^{-3} .

ESTIMATION AND ORDERS OF MAGNITUDE

RECALL

About 1000 kg m^{-3} .

ESTIMATION AND ORDERS OF MAGNITUDE

SPOT THE ERROR

Calculators execute keystrokes; they cannot notice a slip. An order-of-magnitude estimate made first is what catches the misplaced power of ten.

ESTIMATION AND ORDERS OF MAGNITUDE