

Command words and working Scientifically key words

Command words:

Calculate: Students should use numbers given in the question to work out the answer.

Choose: Select from a range of alternatives.

Compare: This requires the student to describe the similarities and/or differences between things, not just write about one.

Complete: Answers should be written in the space provided, for example on a diagram, in spaces in a sentence, or in a table.

Define: Specify the meaning of something.

Describe: Students may be asked to recall some facts, events or process in an accurate way.

Design: Set out how something will be done.

Determine: Use given data or information to obtain and answer.

Draw: To produce, or add to, a diagram.

Estimate: Assign an approximate value.

Evaluate: Students should use the information supplied, as well as their knowledge and understanding, to consider evidence for and against.

Explain: Students should make something clear, or state the reasons for something happening.

Give/ Name / Write: Only a short answer is required, not an explanation or a description.

Identify: Name or otherwise characterise.

Justify: Use evidence from the information supplied to support an answer.

Label: Provide appropriate names on a diagram.

Measure: Find an item of data for a given quantity.

Plan: Write a method.

Plot: Mark on a graph using data given.

Predict: Give a plausible outcome.

Show: Provide structured evidence to reach a conclusion.

Sketch: Draw approximately.

Suggest: This term is used in questions where students need to apply their knowledge and understanding to a new situation.

Use: The answer must be based on the information given in the question. Unless the information given in the question is used, no marks can be given. In some cases students might be asked to use their own knowledge and understanding.

Key Working scientifically / Required practical words:

Accuracy: A measurement result is considered accurate if it is judged to be close to the true value.

Calibration: Marking a scale on a measuring instrument. This involves establishing the relationship between indications of a measuring instrument and standard or reference quantity values, which must be applied. For example, placing a thermometer in melting ice to see whether it reads zero, in order to check if it has been calibrated correctly.

Data: Information, either qualitative or quantitative, that has been collected.

Errors:

Measurement error: The difference between a measured value and the true value.

Anomalies: These are values in a set of results which are judged not to be part of the variation caused by random uncertainty.

Random error: These cause readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next. Random errors are present when any measurement is made, and cannot be corrected. The effect of random errors can be reduced by making more measurements and calculating a new mean.

Systematic error: These cause readings to differ from the true value by a consistent amount each time a measurement is made. Sources of systematic error can include the environment, methods of observation or instruments used. Systematic errors cannot be dealt with by simple repeats. If a systematic error is suspected, the data collection should be repeated using a different technique or a different set of equipment, and the results compared.

Zero error: Any indication that a measuring system gives a false reading when the true value of a measured quantity is zero, eg the needle on an ammeter failing to return to zero when no current flows. A zero error may result in a systematic uncertainty. Evidence Data which has been shown to be valid.

Fair test: A fair test is one in which only the independent variable has been allowed to affect the dependent variable.

Hypothesis: A proposal intended to explain certain facts or observations.

Interval: The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres.

Precision: Precise measurements are ones in which there is very little spread about the mean value. Precision depends only on the extent of random errors – it gives no indication of how close results are to the true value.

Prediction: A prediction is a statement suggesting what will happen in the future, based on observation, experience or a hypothesis.

Range: The maximum and minimum values of the independent or dependent variables; important in ensuring that any pattern is detected. For example a range of distances may be quoted as either: 'From 10 cm to 50 cm' or 'From 50 cm to 10 cm'.

Repeatable: A measurement is repeatable if the original experimenter repeats the investigation using same method and equipment and obtains the same results.

Reproducible: A measurement is reproducible if the investigation is repeated by another person, or by using different equipment or techniques, and the same results are obtained.

Resolution: This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.

Sketch graph: A line graph, not necessarily on a grid, that shows the general shape of the relationship between two variables. It will not have any points plotted and although the axes should be labelled they may not be scaled.

True value: This is the value that would be obtained in an ideal measurement.

Uncertainty: The interval within which the true value can be expected to lie. Whenever a measurement is made, there will always be some uncertainty or doubt about the result obtained. Uncertainty can be expressed in terms of spread of values obtained. For example, a length of 56 cm ± 2 cm would mean the true value could be anywhere between 54 cm and 58 cm. Calculate by finding the difference between the lowest and highest values and dividing by 2.

Validity: Suitability of the investigative procedure to answer the question being asked. For example, an investigation to find out if the rate of a chemical reaction depended upon the concentration of one of the reactants would not be a valid procedure if the temperature of the reactants was not controlled.

Valid conclusion: A conclusion supported by valid data, obtained from an appropriate experimental design and based on sound reasoning.

Variables: These are physical, chemical or biological quantities or characteristics.

Categoric: Categoric variables have values that are labels, eg names of plants or types of material.

Continuous: Continuous variables can have values (called a quantity) that can be given a magnitude either by counting (as in the case of the number of shrimp) or by measurement (eg light intensity, flow rate etc).

Control: Control variable is one which may, in addition to the independent variable, affect the outcome of the investigation and therefore has to be kept constant or at least monitored.

Dependent: Dependent variable is the variable of which the value is measured for each and every change in the independent variable.

Independent: Independent variable is the variable for which values are changed or selected by the investigator.