Revision resources

By visiting: **www.focuselearning.co.uk**
Username: student@eastbarnet32048
Password: 46h4kqesf

By visiting: https://www.my-gcsescience.com/
Username:
Password:

By visiting: https://www.kerboodle.com/users/login
Username:
Password:
Organisation code: ltn7

https://www.freesciencelessons.co.uk/videos/

https://www.senecalearning.com/

Steps to success….

Step 1 Create a revision folder

Step 2 Watch a revision video

Step 3 Make notes to help you learn the topic

Step 4 Consider the required practical

Step 5 Practice what you have learned - Exam style questions / 6 marker (particularly the required practical)

Step 7 record progress on My Science GCSE progress checker

Step 8 If time revisit areas that you are less confident with (use your progress checker to help)

30 Minute Learning Strategy

RECAP
5 minutes

Do a quick recap of the previous topic.

Review your notes and then have another shot at the multiple choice quiz. This will help you retain what you've learned on the previous topic.

LEARN
10 minutes

Choose the next video tutorial. Print out the illustrated note sheets. Watch the video, remembering to stop and rewind when you need to. Make notes on the sheets in your own style.

Completing the note sheets, in your own style and at your own pace, will help you focus. It will stop your mind wandering. It will also create a great set of notes that you can come back to before class tests, your mocks and before the GCSE exams themselves. Some topics will take a little less than 10 minutes and some will be longer. Take the time you need.

APPLY
15 minutes

MULTIPLE CHOICE QUESTIONS
2 minutes

Try the multiple choice questions. Your result will set the topic to ✗ – ✓ so you (and your teacher!) can track which topics you know well, and which require work.

EXAM-STYLE QUESTIONS AND MARK SCHEME
10 minutes

Try the exam-style questions on this topic. Check your answers against the mark scheme. File the corrected answers in your revision folder.

This is when your brain works the hardest. It's also the most useful part, when you 'deep-learn' the science. Doing the questions and checking the mark scheme will also help you learn exam technique: *how* to answer the kind of questions you will find in your GCSE exam paper.

REVIEW
3 minutes

Have a quick look over your notes. Take a bow - another topic covered!

File the notes in your revision file, ready to recap next time round. Use the traffic lights on the video dashboard to keep tabs on your progress.

Know what to revise for each paper (Combined Science).

Biology

Paper 1

1. Cell biology

- Eukaryotic and prokaryotic cells
- Specialised Cells
- Microscope and Magnification 1
- Microscope and Magnification 2
- Stem Cells
- Chromosomes and Mitosis
- Diffusion
- Osmosis
- Active Transport

2. Organisation

- An Introduction to Enzymes
- Enzymes in the digestive system
- Cardiovascular disease
- The Circulatory System
- Health and risk factors
- Transpiration in plants
- Organisation in plants

3. Infection and response

- Preventing the spread of pathogens
- Viral, bacterial, fungal and protist diseases
- Immunity and vaccination
- Fighting diseases with drugs

4. Bioenergetics

- Photosynthesis
- Investigating the rate of photosynthesis
- The Rate of Photosynthesis – Limiting Factors
- Respiration and Metabolism
- The effect of exercise on the body

Biology Paper 1

What's assessed

Biology topics 1–4: Cell Biology; Organisation; Infection and response; and Bioenergetics.

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7 % of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

Relevant Required Practical

1. Microscopy
2. Osmosis
3. Food Tests
4. Enzymes
5. Photosynthesis

Know what to revise for each paper (Combined Science).

Biology

Paper 2

5. Homeostasis and response

- The Nervous System
- Adrenaline and Thyroxine
- Controlling blood glucose
- Hormones in human reproduction

6. Inheritance, variation and evolution

- Genetic Inheritance
- Asexual vs sexual reproduction and meiosis
- DNA and the Genome
- Inherited disorders – Polydactyly
- Inherited disorders – Cystic Fibrosis
- Screening for genetic disorders
- Natural Selection
- Selective Breeding
- Genetic Engineering
- Cloning
- Classification and Evolutionary Trees

7. Ecology

- Communities and Interdependence
- Adaptations
- Measuring the Distribution of Organisms
- Cycling in ecosystems
- Human impact on the environment

Biology Paper 2

What's assessed

Biology topics 5–7: Homeostasis and response; Inheritance, variation and evolution; and Ecology.

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7 % of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

Relevant Required Practical

1. Reaction time
2. Field Investigation

Know what to revise for each paper (Combined Science).

Chemistry

Paper 1

1. Atomic structure

- Atoms, elements, compounds, mixtures
- Separating mixtures
- Scientific models of the atom
- Atomic Structure
- Relative Atomic Mass
- Electronic Structure
- The Periodic Table
- Group 0 – The Noble Gases
- Group 1 – The Alkali Metals
- Group 7 – Halogens

2. Bonding

- Ionic Bonding
- Covalent bonding
- Metallic bonding
- Solids, liquids and gases
- Properties of ionic, covalent and metallic structures
- Giant covalent structures
- Graphene and fullerenes

3. Quantitative Chemistry

- Conservation of mass and balanced chemical equations
- Relative formula mass
- The mole
- Mass changes
- Reacting masses
- Concentration in g/dm3

4. Chemical Changes

- The reactivity of metals
- Displacement reactions
- Extracting metals
- Reactions of acids
- Making Salts
- The pH scale and neutralisation
- Strong and weak acids
- Electrolysis of molten salts
- Using electrolysis to extract metals
- Electrolysis of aqueous salts

5. Energy Changes

- Exothermic and endothermic reactions
- Reaction profile diagrams
- Calculating Energy Changes

Chemistry Paper 1

What's assessed

Chemistry topics 8–12: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry; Chemical changes; and Energy changes.

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7 % of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

Relevant Required Practical

1. Making Salts
2. Electrolysis
3. Temperature changes

Know what to revise for each paper (Combined Science).

Chemistry

Paper 2

6. Rate and extent of chemical change

- Measuring rates of reaction
- Interpreting rate graphs
- Factors affecting rates of reaction
- Collision theory and activation energy (including catalysts)
- Reversible reactions and equilibrium
- Factors affecting equilibrium

7. Organic Chemistry

- Crude oil and alkanes
- Combustion of hydrocarbons
- Cracking and alkenes

8. Chemical Analysis

- Purity and formulations
- Gas tests
- Chromatography

9. Chemistry of the atmosphere

- The Earth's atmosphere
- The greenhouse effect and global warming
- Atmospheric pollutants

10. Using Resources

- Sustainable development
- Potable water
- Alternative methods of extracting metals
- Life cycle assessment

Chemistry Paper 2

What's assessed

Chemistry topics 13–17: The rate and extent of chemical change; Organic chemistry; Chemical analysis; Chemistry of the atmosphere; and Using resources.

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7% of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

Relevant Required Practical

1. Rates of Reaction
2. Chromatography
3. Water purification

Know what to revise for each paper (Combined Science).

Physics

Paper 1

1. Energy

- Energy changes in a system
- Power
- Conservation and dissipation of energy
- National and global energy resources

2. Electricity

- Circuit symbols
- Introduction to Electricity
- Resistors
- Series and Parallel Circuits
- Investigating resistance in circuits
- Domestic uses and safety
- Power and energy transfers
- The National Grid

3. Particle model of matter

- Density
- Solids, liquids and gases
- Specific heat capacity and specific latent heat
- Particle model and pressure

4. Atomic structure

- Atoms and isotopes
- The development of the model of the atom
- Radioactive decay
- Half-life
- Radioactive contamination

Physics Paper 1

What's assessed

Physics topics 18–21: Energy; Electricity; Particle model of matter; and Atomic structure.

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7% of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

<u>Relevant Required Practical</u>

1. Specific Heat Capacity
2. Resistance
3. I-V Characteristics
4. Density

Know what to revise for each paper (Combined Science).

Physics Paper 2

5. Forces

- Scalars and vectors
- Contact and non-contact forces
- Gravity
- Resultant forces
- Work done and energy transfer
- Forces and elasticity
- Distance and Displacement, Speed and Velocity
- Distance-time graphs
- Acceleration
- Velocity-time graphs
- Falling objects
- Newton's laws of motion
- Forces and braking
- Momentum 1

6. Waves

- Transverse and longitudinal waves
- Properties of waves
- Electromagnetic waves 1
- Electromagnetic waves 2

7. Magnetism and electromagnetism

- Magnetism
- The motor effect

Physics Paper 2

What's assessed

Physics topics 22–24: Forces; Waves; and Magnetism and electromagnetism

How it's assessed

- Written exam: 1 hour 15 minutes
- Foundation and Higher Tier
- 70 marks
- 16.7% of GCSE

Questions

Multiple choice, structured, closed short answer, and open response.

Relevant Required Practical

1. Force and extension
2. Acceleration
3. Waves
4. Radiation and absorption

Know what to revise for each paper (Triple).

GCSE BIOLOGY (8461)

Relevant Required Practical

Microscopy.....
Microbiology.....
Osmosis.....
Food tests.....
Enzymes.....
Photosynthesis.....
Reaction time.....
Plant responses.....
Field investigations...
Decay.....

Paper 1

What's assessed

Topics 1–4: Cell biology; Organisation; Infection and response; and Bioenergetics.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

Subject content

1. Cell biology
2. Organisation
3. Infection and response
4. Bioenergetics
5. Homeostasis and response
6. Inheritance, variation and evolution
7. Ecology
8. Key ideas

Paper 2

What's assessed

Topics 5–7: Homeostasis and response; Inheritance, variation and evolution; and Ecology.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

Know what to revise for each paper (Triple).

GCSE CHEMISTRY (8462)

Subject content

1. Atomic structure and the periodic table
2. Bonding, structure, and the properties of matter
3. Quantitative chemistry
4. Chemical changes
5. Energy changes
6. The rate and extent of chemical change
7. Organic chemistry
8. Chemical analysis
9. Chemistry of the atmosphere
10. Using resources

Relevant Required Practical

Making salts .....
Neutralisation .....
Electrolysis.....
Temperature changes...
Rates of reaction .....
Chromatography.....
Identifying ions .....
Water purification.....

Paper 1:

What's assessed

Topics 1–5: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry, Chemical changes; and Energy changes.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

Paper 2:

What's assessed

Topics 6–10: The rate and extent of chemical change; Organic chemistry; Chemical analysis, Chemistry of the atmosphere; and Using resources.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

Know what to revise for each paper (Triple).

GCSE PHYSICS (8463)

Subject content

1. Energy
2. Electricity
3. Particle model of matter
4. Atomic structure
5. Forces
6. Waves
7. Magnetism and electromagnetism
8. Space physics (physics only)

Relevant Required Practical

Specific heat capacity .....
Thermal insulation .....
Resistance .....
I-V characteristics .....
Density.....
Force and extension .....
Acceleration .....
Waves.....
Light.....
Radiation and absorption .....

Paper 1:

What's assessed

Topics 1-4: Energy; Electricity; Particle model of matter; and Atomic structure.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

Paper 2:

What's assessed

Topics 5-8: Forces; Waves; Magnetism and electromagnetism; and Space physics.

Questions in paper 2 may draw on an understanding of energy changes and transfers due to heating, mechanical and electrical work and the concept of energy conservation from Energy and Electricity.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50% of GCSE

Questions

- Multiple choice, structured, closed short answer and open response.

GCSE Required Practical – Biology 1 – Using a light microscope

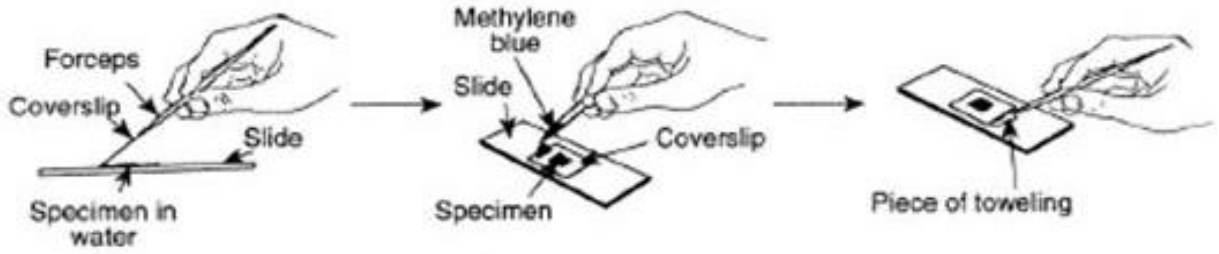
What's the point of the practical?

To find out what cells look like and see how big they are and see how they work.

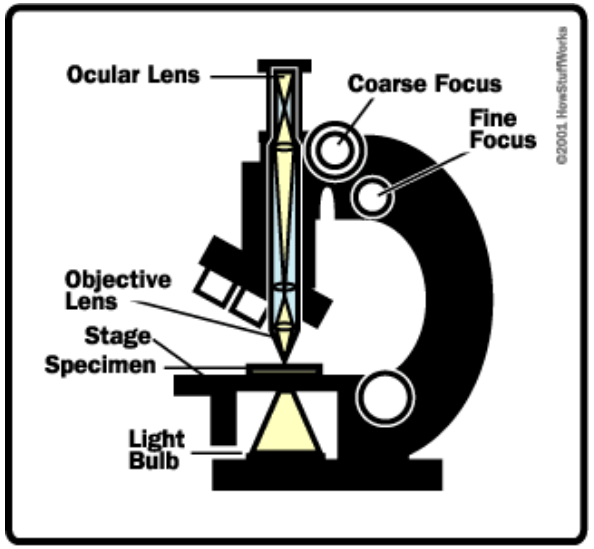
What may they ask us about?

- Make sure you can use and rearrange the equation
- Make sure you know the units:
  1mm = 1000um
  1um = 1000nm
- You may need a ruler to measure the size of images and work out their real size.
- Explain why we can see the nucleus and cell wall but not the mitochondria *(they're far too small and not stained)*
- How can we see smaller parts of cells? (*An electron microscope has much more resolution and magnification)*

Example Apparatus



- Use a stain to make things visible (cell wall, nucleus).
- Get the specimen as flat and thin as possible.
- Start on the smallest lens, focus, then move up a lens.
- a ruler, or eyepiece scale can be used to measure size
- Use the equation:



$$\text{Magnification} = \frac{\text{image size}}{\text{actual object size}}$$

Microscopy Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to prepare a microscope slide to show the contents of cells from onion skin and animal tissue. Some of the equipment they were provided with is shown below:

a small piece of onion

a knife

a white tile

forceps

a microscope slide

a coverslip

a microscope

iodine solution in a dropping bottle

prepared animal and plant cells

Perspex ruler

Describe how they could prepare this slide.

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Use a dropping pipette to put one drop of water onto a microscope slide.
2. Separate one of the thin layers of the onion.
3. Peel off a thin layer of epidermal tissue from the inner surface.
4. Use forceps to put this thin layer on to the drop of water that you have placed on the microscope slide.
5. Make sure that the layer of onion cells is flat on the slide.
6. Put two drops of iodine solution onto the onion tissue.
7. Carefully lower a coverslip onto the slide. Do this by:
   - placing one edge of the coverslip on the slide
   - use the forceps to lower the other edge onto the slide
8. There may be some liquid around the edge of the coverslip. Use a piece of paper to soak this liquid up.

Total 6 marks

GCSE Required Practical – Biology 1 – Investigating Osmosis

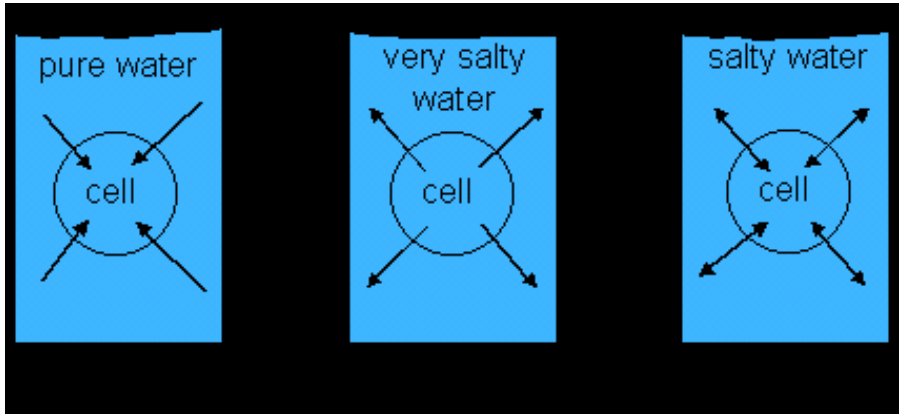
Osmosis: the movement of water from an area with high concentration OF WATER, to an area with lower concentration OF WATER.
Solute: something that dissolves in water

What's the point of the practical?

To find out what happens to cells when you put them in different concentrations of sugar or salt solutions. (to see how the water moves in or out of the plant tissue / to find Isotonic point (H))

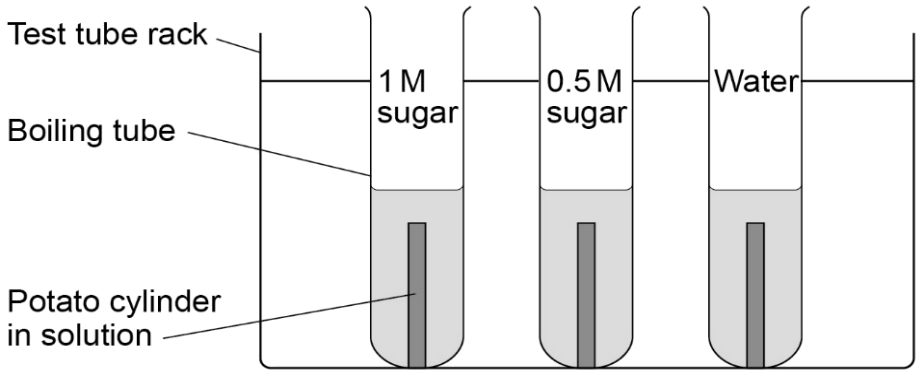
Results

- High concentration of sugar in solution = water moves out of potato cells into the solution. Potato gets smaller.
-Low concentration of sugar in solution = water moves into the potato cells from the solution. Potato gets bigger.



-If no water goes in or out of the potato overall and it doesn't change mass, then the solution is exactly the same concentration as inside the potato (Isotonic point)

Example Apparatus



- Different concentrations of sugar (or salt)
- Measure the length (or mass) of the potato cylinders before and after.

What may they ask us about?

- Control variables
- Accuracy of measurements – why should you remove excess water with paper towel before weighing
- Use a graph of results to find the concentration inside the potato cells
- Why can the water, but not the sugar/salt move through the membrane?

Osmosis Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate osmosis in potato tissue. Some of the equipment they were provided with is shown below:

- a potato
- a cork borer or potato chipper/ vegetable stick cutter
- a ruler
- a 10 cm^3 measuring cylinder
- labels
- three boiling tubes
- a test tube rack
- paper towels
- a sharp knife
- a white tile
- a range of sugar solutions
- distilled water
- a top-pan balance.

Describe how they could carry out this investigation

Osmosis Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Use a cork borer to cut three potato cylinders of the same diameter.
2. Trim the cylinders so that they are all the same length (about 3 cm).
3. Accurately measure and record the length and mass of each potato cylinder.
4. Measure 10 cm^3 of the 0.5 M sugar solution and put into the first boiling tube. Label boiling tube as: 0.5 M sugar.
5. Measure 10 cm^3 of 0.25 M sugar solution and put into the second boiling tube. Label boiling tube as: 0.25 M sugar.
6. Measure 10 cm^3 of the distilled water and put into the third boiling tube. Label boiling tube as water.
7. Add one potato cylinder to each boiling tube. Make sure you know the length and mass of each potato cylinder in each boiling tube.
8. **Record the lengths and masses of each potato cylinder**
9. Leave the potato cylinders in the boiling tubes overnight in the test tube rack.
10. Remove the cylinders from the boiling tubes and carefully blot them dry with the paper towels.
11. Re-measure the length and mass of each cylinder

Total 6 marks

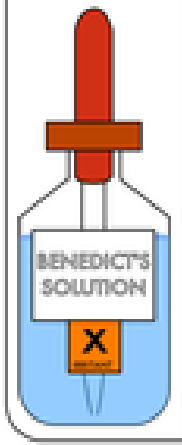
GCSE Required Practical – Biology 1 – Food Tests

What's the point of the practical?

To find out if sugars, starch and/or proteins are in certain foods.

Example Apparatus and results

BIOCHEMICAL (FOOD) TESTS

CHEMICAL	TESTS FOR ...?	HOW TO CARRY OUT THE TEST	RESULT	CHEMICAL	TESTS FOR ...?	HOW TO CARRY OUT THE TEST	RESULT
	Starch	1.) Add the iodine solution directly to the substance to be tested (in solid or liquid form) and look for a colour change.	Turns blue black with starch		Protein	1.) Add Biuret's to the solution/ suspension to be tested and look for a colour change.	Turns purple with protein
	Reducing Sugar	1.) Add Benedict's to the solution/ suspension to be tested. 2.) Heat for 2 mins in a water bath at boiling point and look for a colour change.	Turns brick red with reducing sugars (green/ yellow/ orange if less sugar present)		Lipid (known as the Emulsion test)	1.) Add ethanol to the solution/ suspension to be tested and shake thoroughly. 2.) Then add water and look for a colour change.	Turns cloudy/ milky with lipid

What may they ask us about?

- Qualitative test (tell you just yes/no) vs Quantitative (tells you how much) tests.
- Sources of error – how could you make mistakes?
- Why is it hard to judge colour change accurately?
- Resolution of measurements, repeatability, reproducibility etc.

Explain in detail how you would test a gingerbread-biscuit solution for the presence of starch, sugar, and protein. (QWC, 6 marks)

Question marking guidance

Explain in detail how you would test a gingerbread-biscuit solution for the presence of starch, sugar, and protein. (QWC, 6 marks)

1–2 marks

There needs to be a **basic description** of the solutions involved in the tests. Students need to have stated at least one solution and positive result correctly. Students also need to have included at least three of the scientific points listed below.

3–4 marks

There needs to be a **clear description** of the solutions involved in the tests and how to use them. Students need to have described at least two correct solutions and positive results. Students should give at least six of the scientific points given below. Spelling and grammar is mostly correct, and the answer is presented logically.

5–6 marks

There is a **full and detailed description** of the solutions involved in the tests and how to use them. Students need to have described all three methods and positive results. The answer is well structured and spelling and grammar nearly all correct. Students should give at least nine of the scientific points given below.

Scientific points

- The gingerbread-biscuit solution can be tested using chemical food tests.
- The test for starch uses iodine solution.
- Add a few drops of iodine solution to the gingerbread-biscuit solution.
- If the solution turns blue-black then starch is present.
- The test for sugar uses Benedict's solution.
- Add a few drops of Benedict's solution to the gingerbread-biscuit solution. Heat the test tube containing the solutions in a water bath.
- If the solution turns orange-red, the food contains sugar.
- The test for protein uses copper sulfate solution and sodium hydroxide solution.
- Add a few drops of copper sulfate solution to the food solution.
- Add a few drops of sodium hydroxide solution.
- If the solution turns purple, the food contains protein.

GCSE Required Practical – Biology 1 – Investigating amylase enzyme

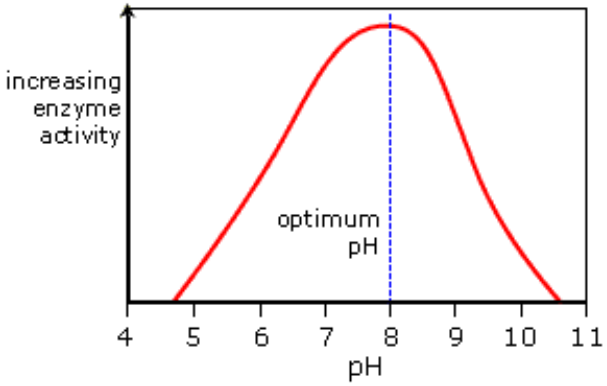
Enzyme: a biological catalyst. Speeds up reactions in the body by lowering the activation energy.
pH: how acidic or alkali a substance is (1 = strong acid, 7=neutral, 14 = strong alkali)
Amylase: an enzyme that breaks down starch into sugar

What's the point of the practical?

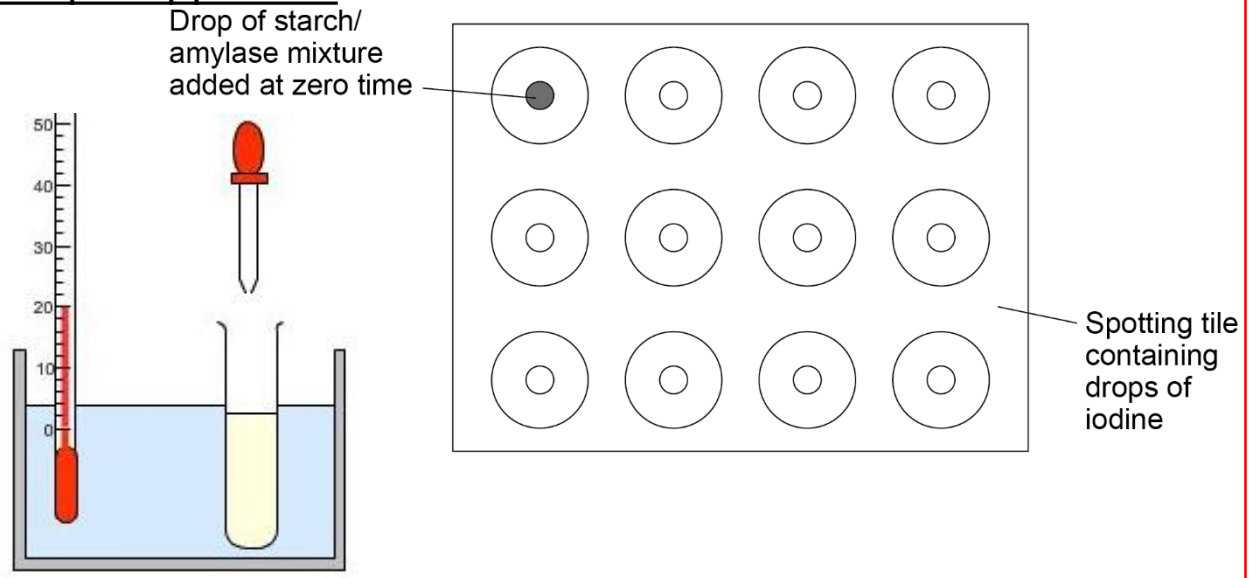
To find out what happens to the rate of enzyme activity when the pH changes.

Results

- At low pH and high pH, the iodine keeps turning black because the enzyme has been denatured.
- After just a few minutes at pH 7-9, the iodine stays brown – the starch has all broken down into sugar.



Example Apparatus



- Starch reacts with amylase in a water bath
- Take samples from the mixture every 30 seconds and add it to iodine
- Iodine goes black = starch present
- Iodine stays brown = no starch present (it's reacted)

What may they ask us about?

- Why do you need a water bath? *(To maintain the correct temperature, because temperature affects reaction rate)*
- If you test at pH 3,4,5,6,7,8,9 and 10, Why don't we know the exact optimum pH? *(because although two answers may both show quick reactions (e.g. pH7 and pH8), the actual optimum could be between those number (e.g. pH 7.6) so you need to test different pH's to find out the exact optimum.*
- Sources of error and weaknesses – e.g. in measuring, starting and stopping timers etc

Enzymes Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the effect of pH on the enzyme amylase. Some of the equipment they were provided with is shown below:

- test tubes
- a test tube rack
- water bath (electrical or bunsen burner and beakers)
- spotting tiles
- 5cm^3 measuring cylinder
- syringes
- a stop clock
- starch solution
- amylase solution
- buffered solutions covering a range of pH, each with a labelled syringe/ plastic pipette
- iodine solution
- syringes.

Describe how they could carry out this investigation

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Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Place one drop of iodine solution into each depression on the spotting tile.
2. Place labelled test tubes containing the buffered pH solutions, amylase solution and starch solutions in to the water bath
3. Allow the solutions to reach 30 °C
4. Add 2cm^3 of one of the buffered solutions to a test tube.
5. Use the syringe to place 2 cm^3 of amylase into the buffered pH solution.
6. Use another syringe to add 2 cm^3 of starch to the amylase/buffer solution.
7. Immediately start the stop clock and leave it on throughout the test.
8. After 10 seconds, remove one drop of the mixture with a glass rod.
   Place this drop on the first depression of the spotting tile with the iodine solution.
9. Use the glass rod to remove one drop of the mixture every 10 seconds. Put each drop onto the iodine solution in the **next** depression on the spotting tile. Continue until the iodine solution and the amylase/buffer/starch mixture remain orange.
10. Repeat the procedure with solutions of other pHs

Total 6 marks

GCSE Required Practical – Biology 1 – Light and Photosynthesis

Photosynthesis: when plants use carbon dioxide and water to make glucose (and oxygen). Happens in the chloroplast and needs light to happen.

What's the point of the practical?

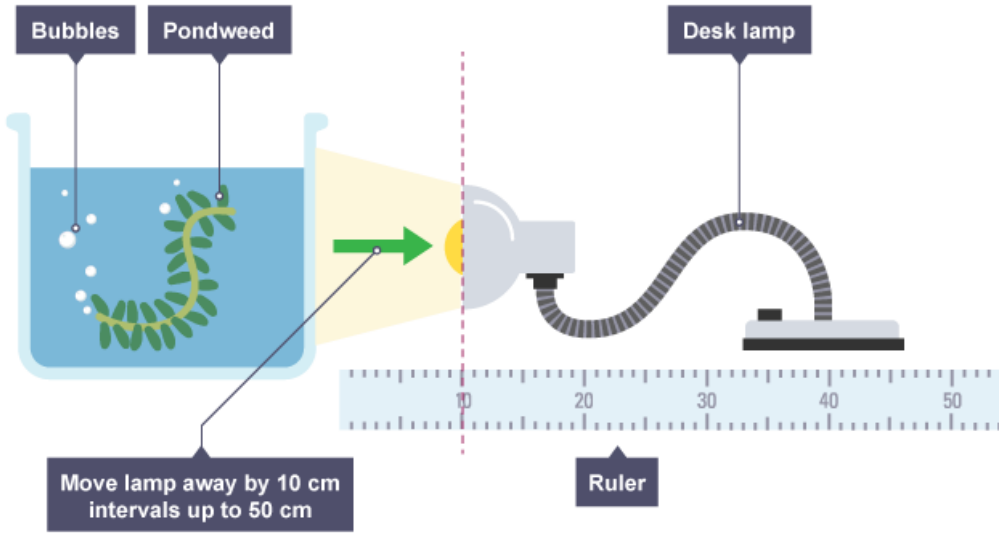
To find out what happens to the rate of photosynthesis when we change the light intensity

Photosynthesis

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

carbon dioxide + water ⟶ glucose + oxygen

Example Apparatus



Results

- The closer the lamp, the quicker the bubbles are produced (so higher rate of photosynthesis)

What may they ask us about?

- Why results may be inaccurate (*difficult to count very small bubbles, each bubble counts as '1' no matter how big it is*)
- Why should you leave the plant for a few minutes before starting to count bubbles (*as it takes time for the plant to adjust to the light/temperature and for photosynthesis to reach the correct rate*).
- Heat from the lamp is a source of error, how could you avoid this? (*Place a glass screen in front of the beaker so that light gets through but heat doesn't*)
- What are the other limiting factors apart from light? Why will rate of photosynthesis level off, even with maximum light? (*The plant also needs enough temperature and CO_2*)

Photosynthesis Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the effect of light intensity on photosynthesis in pondweed. Some of the equipment they were provided with is shown below:

- a boiling tube
- freshly cut 10 cm piece of pondweed
- a light source
- a ruler
- a test tube rack
- a stop watch
- 0.2% solution of sodium hydrogen carbonate solution
- a glass rod.

Describe how they could carry out this investigation. You may wish to draw a diagram to show how the equipment can be set up.

Photosynthesis Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Set up a test tube rack containing a boiling tube at a distance of 10 cm away from the light source
2. Fill the boiling tube with the sodium hydrogen carbonate solution.
3. Put the piece of pondweed into the boiling tube with the cut end at the top. Gently push the pondweed down with the glass rod.
4. Leave the boiling tube for 5 minutes.
5. Start the stop watch and count the number of bubbles produced in one minute.
6. Repeat the count twice more. Then use the data to calculate the mean number of bubbles per minute.
7. Repeat steps **1–7** with the test tube rack and boiling tube at distances of 20 cm, 30 cm and 40 cm from the light source.

Total 6 marks

GCSE Required Practical – Biology 2 – Investigating reaction time

Reaction time – the time it takes for you to react. You need to detect the stimulus (eyes) and send an impulse to the brain (sensory neurone) and down to the hand (motor neurone)

What's the point of the practical?

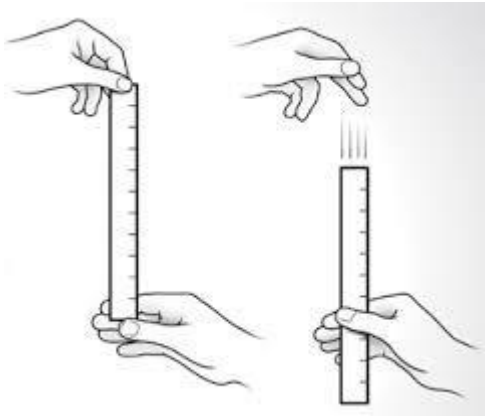
To find out how a certain variable affects reaction time.

Results

- People react quicker with practice and if they are concentrating.
- They react slower if distracted in any way.

Example Apparatus

- Dropping a metre stick
- Or using an online reaction test to measure reaction time (reaction distance with metre stick).
- Many IV's could be tested



e.g. the effect of listening to music, drinking alcohol, drinking caffeine, taking drugs or medicines, gender, age, amount of practice

What may they ask us about?

- Control variables – what had to be kept the same and how did you do it?
- Why is it important to repeat? Calculate means etc
- Range of results, resolution of measurements, uncertainty of results
- Ethical considerations
- Use of control groups to compare to

Reaction Time Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate whether practice reduces human reaction times. Some of the equipment they were provided with is shown below:

- a metre ruler
- a chair
- a table
- a partner

Describe how they could carry out this investigation

Reaction Time Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Use your weaker hand for this experiment. If you are right handed then your left hand is your weaker hand.
2. Sit down on the chair with good upright posture and eyes looking across the room.
3. Place the forearm of your weaker arm across the table with your hand overhanging the edge of the table.
4. Your partner will hold a ruler vertically with the bottom end (the end with the 0 cm) in between your thumb and first finger. Practice holding the ruler with those two fingers.
5. Your partner will take hold of the ruler and ask you to remove your fingers.
6. Your partner will hold the ruler so the zero mark is level with the top of your thumb. They will tell you to prepare to catch the ruler.
7. Your partner will then drop the ruler **without** telling you.
8. You must catch the ruler as quickly as you can when you sense that the ruler is dropping.
9. After catching the ruler, look at the number level with the top of your thumb.
10. Continue to repeat the test several times.
11. Swap places with your partner. Repeat the experiment to get their results.

Total 6 marks

GCSE Required Practical – Biology 2 – Measuring population size

Population: all the individuals of a species in a particular area.
Distribution: how the individuals are 'spread out' across a certain area

Abiotic factors: non-living factors

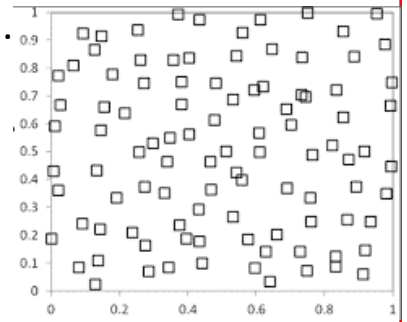
biotic factors: living factors

What's the point of the practical?

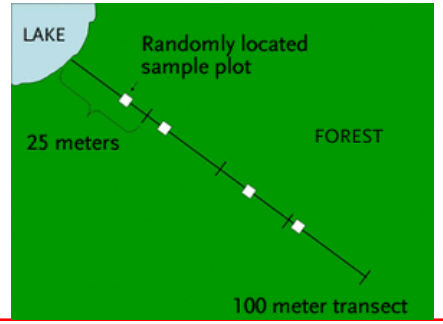
To find out how different factors affect how species are distributed

Results

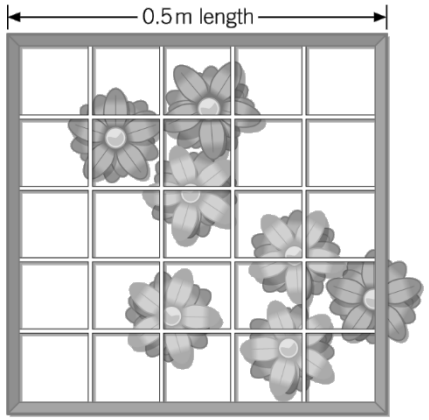
- Random sampling – used when you want to know how the organisms are spread out across an area.



- Line transect – used when you want to see how one particular feature (e.g. a river/road/building) affects an area. You take samples in a line (called a transect) and repeat to compare the difference near and far from the feature.



Example Apparatus



- Quadrat – frame of a certain size used to isolate a particular area so you can see what's in that certain space

What may they ask us about?

- Accuracy of measurements – is it 100% accurate?
- Reproducibility and validity of data – is it completely fair?
- Calculate means and work out the total number in a certain area.
- How could you improve the sample to make it more representative?

Field Investigations Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the population size of daisies in trampled and un-trampled parts of a school field. Some of the equipment they were provided with is shown below:

- a 0.5 m^2 quadrat
- a 30 m tape measure
- a clipboard
- a pen
- paper.

Describe how they could carry out this investigation

Field Investigations Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Put the 30 m tape measure across a trampled area of the school field to form a transect line.
2. Put the 1 m^2 quadrat against the transect line. One corner of the quadrat should touch the 0 m mark on the tape measure.
3. Count the number of daisy plants within the quadrat.
4. Record the number of daisies counted within the quadrat
5. Move the quadrat 5 m up the transect line and count the number of daisy plants again. Record in the table.
6. Continue to place the quadrat at 5 m intervals and count the number of daisy plants in each quadrat.
7. Calculate the mean number of daisy plants per m^2 for the trampled area.
8. Move the 30 m tape measure to an un-trampled area of the school field to form the new transect line.
9. Repeat steps **2–7** for the un-trampled transect line.
10. Compare the population size of daisies in the trampled and un-trampled areas of the field.

Total 6 marks

GCSE Required Practical –Chemistry 1 – Making a salt from a carbonate or oxide

Salt: an ionic substance soluble: something that dissolves in water insoluble: something that doesn't dissolve in water

Acid + metal carbonate → metal salt + water + carbon dioxide Acid + metal oxide → metal salt + water

What's the point of the practical?

To find out how to make a pure, dry sample of a soluble salt from an insoluble carbonate or oxide.

Results

- Hydrochloric Acid makes Metal Chlorides
- Sulfuric Acid makes Metal Sulfates
- Nitric Acid makes Metal Nitrates

What may they ask us about?

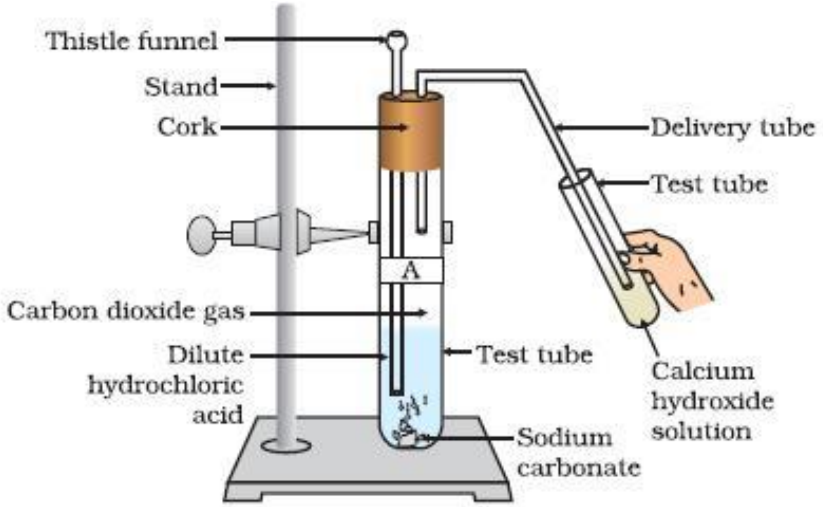
- How do you get solid crystals from the salt solution (*crystallize, evaporate the water*)
- Why do we heat the solution
- What are the risks and safety precautions
- Why do we filter the solution
- How could we test the pH of the salt solution?
- Name the salt produced.

Example Apparatus

Acid + Carbonate

Limewater (calcium hydroxide can be used

To show Co_z is produced



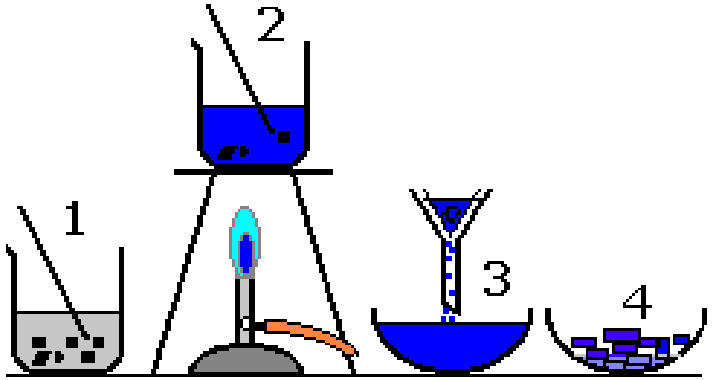
Acid + Metal Oxide

- Excess of metal oxide added
- Need to heat the solution

to ensure as acid fully reacts with available metal oxide particles

- Then filter to remove

Excess metal oxide



Making Salts From Metal Oxides

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Copper(II) oxide is an insoluble base.

Describe how you could make crystals of copper(II) sulfate from copper(II) oxide.

(6 marks)

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
No relevant content	There is a brief description how copper sulphate is made	There is a scientific description of the preparation of copper sulphate from copper oxide and sulphuric acid	There is a clear and detailed scientific description of how to prepare copper sulphate from copper oxide and sulphuric acid and how crystals are obtained from this mixture
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of chemistry points made in the response

- Use dilute sulphuric acid
- Place acid in a beaker
- Warm the acid
- Add copper oxide
- In small amounts
- Until there is an excess and no further reaction can take place
- Filter to remove excess copper oxide
- Allow the excess water to evaporate
- And crystals of copper sulphate to form
- Remove crystals

Total 6 marks

GCSE Required Practical – Chemistry 1 – Electrolysis

Electrolysis: when a salt solution is separated using electricity

What's the point of the practical?

To find out how different solutions behave when electrolysed

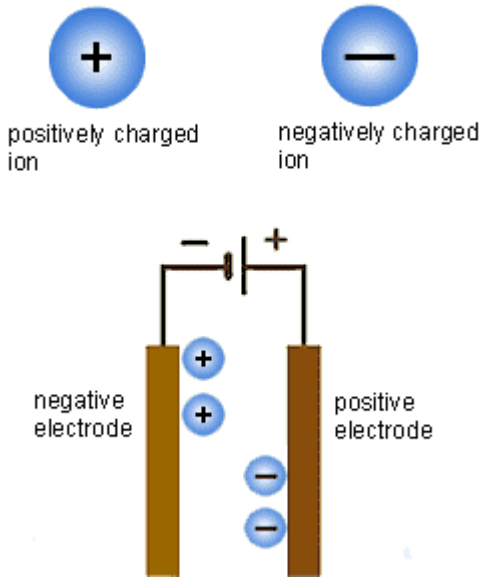
What may they ask us about?

- How could you test the gas that is produced (*hydrogen = pop, chlorine = bleaches damp litmus paper).*
- What happens when the …….. Ions get to the ……. Electrode? (*positive ions are reduced – gain electrons. Negative ions are oxidised – lose electrons).*
- What would happen if you added universal indicator to the solution? (*turns purple – hydroxide is produced – alkali).*

Example Apparatus

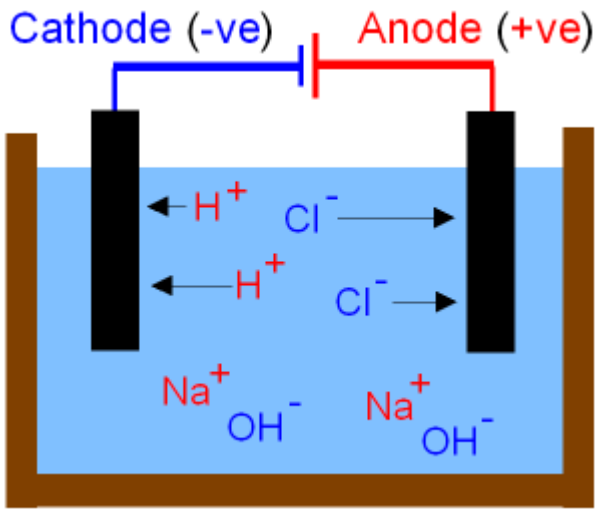
Molten compounds or less reactive salt solutions

- Positive ions to negative electrode. Negative ions to positive electrode. Easy.



More reactive metal solutions e.g. Sodium Chloride solution (Brine)

- If the metal is more reactive than Hydrogen
- Hydrogen is produced at the Negative electrode (instead of the metal).
- Metal hydroxide is produced In the solution.



Electrolysis Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate what happens when aqueous solutions are electrolysed using inert electrodes. They were provided with the equipment below

- 0.5M copper(II) chloride solution
- 0.5M sodium chloride solution
- 0.5M copper(II) sulfate solution
- 0.5M sodium sulfate solution
- petri dish lid with bored holes
- two carbon rod electrodes with support bungs
- two crocodile / 4mm plug leads
- low voltage power supply

Describe how they could carry out this investigation. You may also want to include a diagram showing how the equipment is set up.

Electrolysis Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

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Examples of chemistry points made in the response

- Pour copper (II) chloride solution into the beaker to about 50 cm^3.
- Add the lid and insert carbon rods through the holes.
- **The rods must not touch each other**
- Attach crocodile leads to the rods. Connect the rods to the **dc (red and black)** terminals of a low voltage power supply
- Select 4 V on the power supply and switch on.
- Look at both electrodes. Record what you see
- After no more than five minutes, switch off the power supply. Examine the negative electrode
- Repeat steps using solutions of:
  - copper (II) sulfate
  - sodium chloride
  - sodium sulfate.

Total 6 marks

GCSE Required Practical –Chemistry 1 – Temperature changes in solutions

Exothermic reaction: releases energy (heat exits) Endothermic reaction: absorbs energy (gets cold)

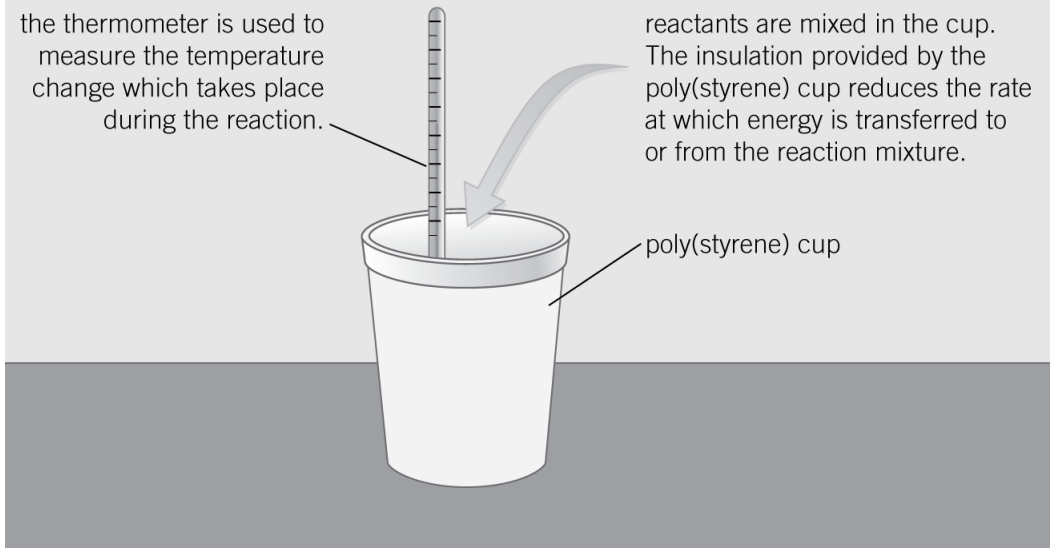
What's the point of the practical?

To find out how different variables affect energy changes in solutions.

Results

- Displacement reactions are exothermic
- Neutralisation reactions are exothermic

Example Apparatus



- Displacement (e.g. Copper Sulfate + Iron → Iron Sulfate + Copper)
- Neutralisation

(e.g. Hydrochloric Acid + Sodium Hydroxide → Sodium Chloride + Water)

What may they ask us about?

- Why do you use a polystyrene cup / lid? (*to reduce temperature loss to the surroundings - makes results more accurate)*
- Resolution and accuracy of measurements.
- Repeatability, calculating mean results, uncertainty etc

Temperature Changes Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate temperature changes which take place when an acid is neutralised by an alkali. They were provided with the equipment below

- 2 M dilute hydrochloric acid
- 2 M sodium hydroxide solution
- expanded polystyrene cup and lid
- 250 cm^3 beaker
- 10 cm^3 measuring cylinder
- 50 cm^3 measuring cylinder
- thermometer.

Describe how they could carry out this investigation

Temperature Change Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

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Examples of chemistry points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Use the 50 cm^3 measuring cylinder to put 30 cm^3 dilute hydrochloric acid into the polystyrene cup.
2. Stand the cup inside the beaker. This will make it more stable.
3. Use the thermometer to measure the temperature of the acid.
4. Put 5 cm^3 sodium hydroxide solution into the 10 cm^3 measuring cylinder and pour the sodium hydroxide into the cup.
5. Fit the lid and gently stir the solution with the thermometer through the hole.
6. Repeat these steps and add further 5 cm^3 amounts of sodium hydroxide to the cup. A total of 40 cm^3 needs to be added.
7. Calculate the **mean** maximum temperature reached for each of the sodium hydroxide volumes.

Total 6 marks

GCSE Required Practical –Chemistry 2 – How does concentration affect rate of reaction

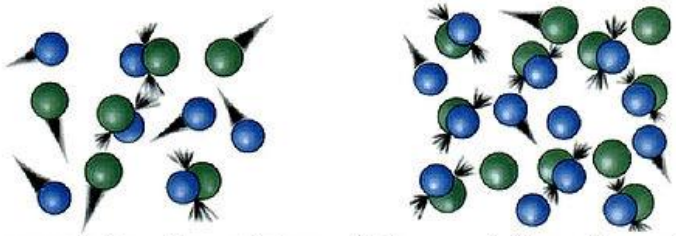
Concentration: the amount of substance in a certain space

What's the point of the practical?

To find out how changes in concentration affect the rate of reaction.

Results

- The higher the concentration, the faster the reaction rate



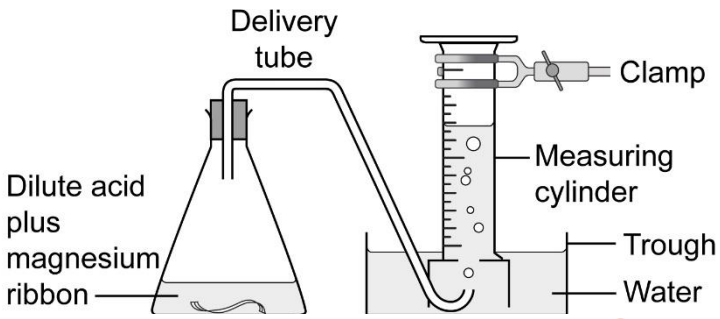
Low concentration = Few collisions High concentration = More collisions

What may they ask us about?

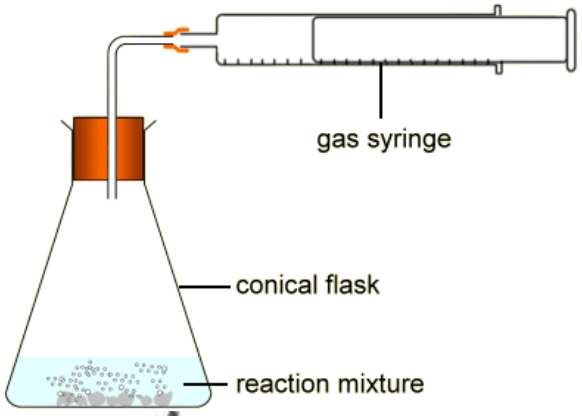
- What are the sources of errors that could lead to anomalous results? (*not getting the bung in quickly enough, starting the timer exactly on time etc)*
- Resolution and accuracy of measurements
- Control variables – just change the concentration – everything else has to stay the same (e.g. why must temperature be controlled)

Example Apparatus

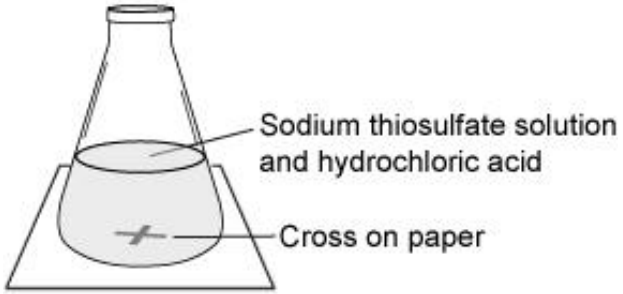
Measuring cylinder
- used to measure gas Production over time



Gas syringe - used to measure gas production over time



'Disappearing' cross – used to measure how quickly the colour changes



Rates of Reaction Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to carry out an investigation into how the concentration of a solution affects the rate of a chemical reaction. They were provided with the equipment below

- 40 g/dm^3 sodium thiosulfate solution
- 2.0 M dilute hydrochloric acid
- 10 cm^3 measuring cylinder
- 100 cm^3 measuring cylinder
- 100 cm^3 conical flask
- printed black paper cross
- stop clock.

Describe how they could carry out this investigation

Rates of Reaction Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of chemistry points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

- Use a measuring cylinder to put 10 cm^3 sodium thiosulfate solution into the conical flask.
- Use the measuring cylinder to then add 40 cm^3 water. This dilutes the sodium thiosulfate solution to a concentration of 8 g/dm^3.
- Put the conical flask on the black cross.
- Put 10 cm^3 of dilute hydrochloric acid into the 10 cm^3 measuring cylinder.
- Put this acid into the flask. At the same time swirl the flask gently and start the stopclock.
- Look down through the top of the flask. Stop the clock when you can no longer see the cross.
- **Take care to avoid breathing in any sulfur dioxide fumes.**
- Repeat steps **1–5** four times, **but in step 1 use:**

  20 cm^3 sodium thiosulfate + 30 cm^3 water (concentration 16 g/dm^3)

  30 cm^3 sodium thiosulfate + 20 cm^3 water (concentration 24 g/dm^3)

  40 cm^3 sodium thiosulfate + 10 cm^3 water (concentration 32 g/dm^3)

  50 cm^3 sodium thiosulfate + no water (concentration 40 g/dm^3)
- Repeat the experiment and calculate the **mean** time for each of the sodium thiosulfate concentrations. Leave out anomalous values from your calculations.

Total 6 marks

GCSE Required Practical –Chemistry 2 –Identifying substances using chromatography

Chromatography: the process where a dissolved substance is separated by running a solvent along a material (e.g paper)

What's the point of the practical?

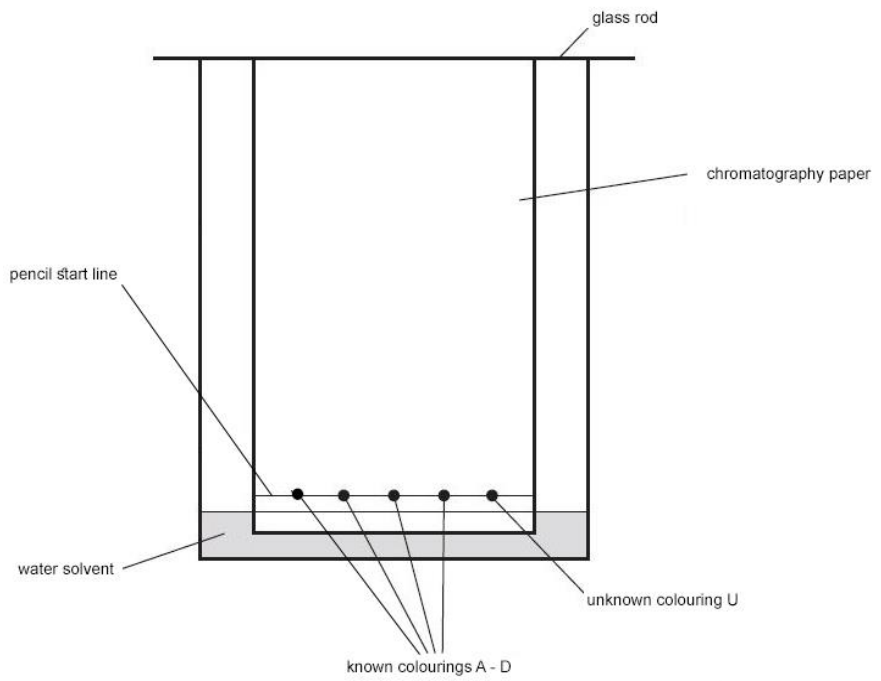
To separate substances and identify what they're made of

Results

- The substance moves up the paper (stationary phase). It is carried by the solvent (mobile phase). Each substance goes a certain distance

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

Example Apparatus



What may they ask us about?

- Why must the start line be drawn in pencil? (*because pencil does not smudge/run in the solvent whereas pen would*)
- Why does there need to be a lid? (*to stop the solvent from evaporating*)
- Measure the R_f value – be accurate. Compare different substances with different R_f values. See what substances are contained in certain mixtures
- Sources of error, resolution or measurements etc

Chromatography Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Forensic Science labs often use chromatography techniques to identify unknown substances. Describe in detail how chromatography is carried out and how you could use the results from your investigation.

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
No relevant content	There is a brief description of what chromatography is	There is a description of what chromatography is and how it can be carried out	There is a description of what chromatography is, how it can be carried out and how you can use the results
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of Chemistry points made in the response

We can use chromatography to separate the components of inks and dyes

Method:

1. Draw a pencil line 2 cm from the bottom of the chromatography paper.
2. Put a small spot of inks A-D and the unknown sample on the pencil line, each spot should be about 0.5 cm from the previous spot
3. Using the pencil write the name of each colour by the corresponding spot.
4. In a beaker add about 1cm in depth of water.
5. Place the chromatography paper in the beaker making sure that it does not touch the sides
6. Allow the water to rise up the paper.
7. When it reaches the top take the paper out of the water, carefully examine it.
8. Compare your results to the standard solutions to determine what your unknown ink is.

Total 6 marks

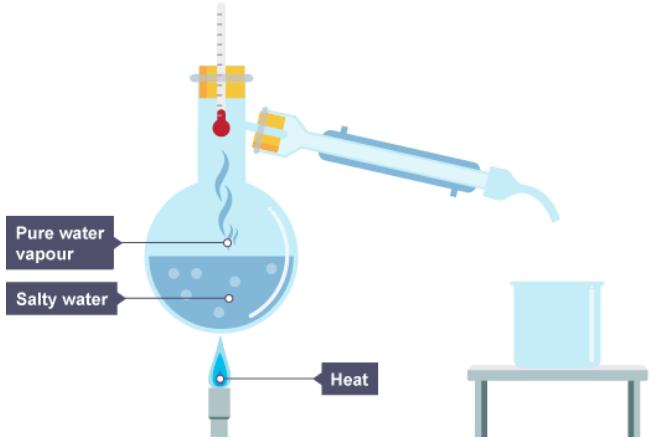
GCSE Required Practical –Chemistry 2 –Purifying and testing water

Potable water = drinkable water

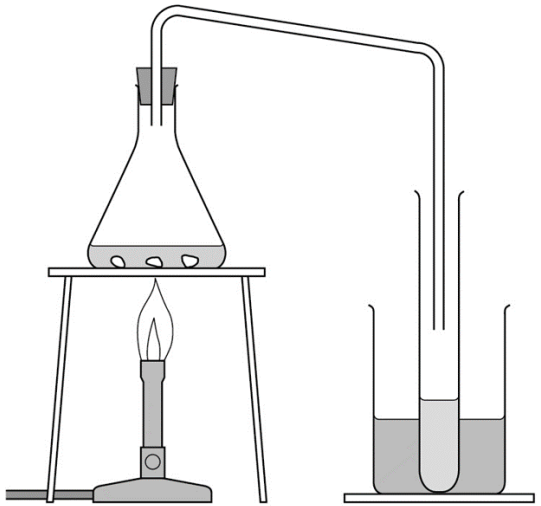
What's the point of the practical?

To analyse and purify water from different sources

Example Apparatus



Or..



Results

- Pure water boils at exactly 100°C and it's pH is 7
- Salt water contains sodium chloride
- Distillation = Heat the solution, the water evaporates, the salt stays in the container.

What may they ask us about?

- Explain how distillation works (*water evaporates at lower temperature as it has a lower boiling point than the dissolved solids, then it condenses back into liquid as it cools down)*
- Why is it not economical to do this on a large scale to make drinking water? (*it costs too much to heat the water*)
- Why may you not get all the water from the solution? (*some does not evaporate, some liquid stays in the tube*)

Water Purification Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to carry out a distillation of salt water to produce potable water and test to check for salt still in it. Some of the equipment they were provided with is shown below:

- 10 cm^3 salt water
- delivery tube with bung
- test tubes [Symbol] 2
- ice
- test tube rack
- nichrome wire
- dilute nitric acid
- silver nitrate solution

Describe how they could carry out this investigation. You may wish to draw a diagram showing how to set up any equipment.

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of chemistry points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Pour around 1 cm depth of the salt water into a test tube in the rack. Dip the nichrome wire into this solution, and then hold the tip of the wire in a blue Bunsen burner flame. A yellow flame test confirms the presence of sodium ions.
2. Add a few drops of dilute nitric acid to this solution. Then add 1 cm depth of silver nitrate solution. A white precipitate with nitric acid and sliver nitrate solution confirms the presence of chloride ions.
3. Place the remaining salt water in the conical flask.
4. Make sure the conical flask is held on the tripod and gauze using the clamp stand.
5. Put a mixture of ice and water in the beaker surrounding the test tube.
6. Boil the water using the Bunsen burner. Then reduce the heat so that the water boils gently.
7. Distilled water will collect in the cooled test tube. Collect about 1 cm depth of water in this way, then stop heating.
8. Repeat the tests in steps **1** and **2** again using the distilled water. Make sure that the nichrome wire and test tube have been cleaned.

Total 6 marks

GCSE Required Practical – Physics 1 – Specific Heat Capacity

Specific Heat Capacity: the amount of energy needed to raise the temp of 1kg by 1°C

What's the point of the practical?

To find out the specific heat capacity of a material.

(You'll need to heat it and work out how much energy has gone in.)

If you haven't got a joulemeter, but do have a ammeter, voltmeter or power meter you can work out the amount of energy by:

Energy = power x time

Power = current x potential difference

Results:

$$\text{specific heat capacity } c\ (\text{J/kg °C}) = \frac{\text{energy transferred } \Delta E\ (\text{J})}{\text{mass } m\ (\text{kg}) \times \text{temperature change } \Delta\theta\ (°\text{C})}$$

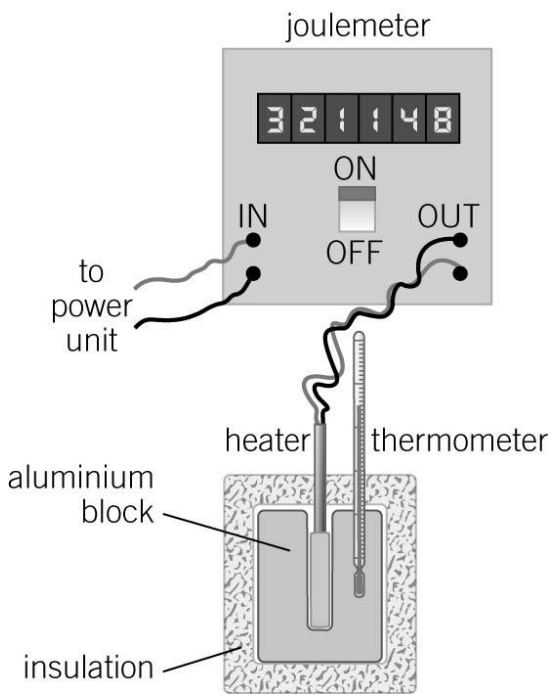
Example Apparatus

Joulemeter – measures energy going into the heater in joules

Heater – heats the block

Insulation – stops heat escaping into the atmosphere

Thermometer – measures the temperature rise



What may they ask us about?

Why do you need to insulate the block (*to stop heat loss to the atmosphere*)

Why is your answer not the true value (*because not all the heat was transferred into the block and through to the thermometer*)

Why is the temperature increase slower at first? *(because it takes some time for the block to heat up and for the heat to reach the thermometer.)*

It may not be a block of metal. You could use a kettle to heat an amount of water or any other way of heating something.

What's the **resolution** of temperature measurements? This experiment could be repeated and you'd get slightly different readings. They could ask about **repeatability** and ask you to calculate the **mean** or the **uncertainty**.

Specific Heat Capacity Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate what the specific heat capacity of copper is? Some of the equipment they were provided with is shown below:

- copper block wrapped in insulation, with two holes for a thermometer and heater
- thermometer
- pipette to put water in the thermometer hole
- 30 W heater
- 12 V power supply
- insulation to wrap around the blocks
- ammeter and voltmeter
- five 4 mm leads
- stop watch or stop clock
- balance.

Describe how they could carry out this investigation

Specific Heat Capacity Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Measure and record the mass of the copper block in kg.
2. Place a heater in the larger hole in the block.
3. Connect the ammeter, power pack and heater in series.
4. Connect the voltmeter across the power pack.
5. Use the pipette to put a small amount of water in the other hole.
6. Put the thermometer in this hole.
7. Switch the power pack to 12 V. Switch it on.
8. Record the ammeter and voltmeter readings. These shouldn't change during the experiment.
9. Measure the temperature and switch on the stop clock.
10. Record the temperature every minute for 10 minutes.

Total 6 marks

GCSE Required Practical – Physics 1 – Investigating Resistance

Resistance: how difficult it is for current to flow through part of the circuit.

What's the point of the practical?

To find out resistance of a wire.

(You could look at different lengths of wire, different thicknesses, or even different temperatures)

Results:

$$\text{resistance (W)} = \frac{\text{potential difference (V)}}{\text{current (A)}}$$

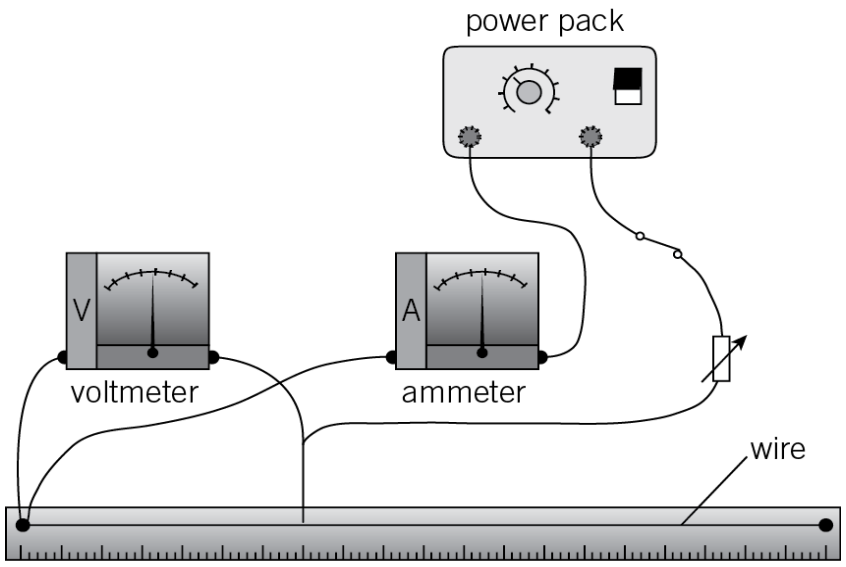
The longer the wire, the more resistance
The thicker the wire, the less resistance
The higher the temperature the more resistance

Example Apparatus

Voltmeter: measures the potential Difference

Ammeter: measures the current

Metre stick:
Measures the length of wire that the current is going through



What may they ask us about?

- Why must the power pack be kept on a low potential difference / What are the hazards *(The wire will get very hot, could burn you)*
- Explain how the temperature affects the resistance (*as the wire gets hot, the ions inside the wire vibrate faster so there are more collisions with the electrons cannot flow as easily)*
- Why is it important to switch the electricity off in between each reading (*to let the wire cool down, as temperature affects resistance)*
- What sort of error could cause all the ammeter/voltmeter readings to be too high (*a zero error – the meters need to be set at zero to start with)*
- Resolution of measurements, repeatability, reproducibility, control variables etc etc

Resistance in a wire

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Bob has been asked to produce a fuse that has 3.2 ohms of resistance. He cannot change the thickness of the wire but can change its length. Explain in detail how bob could work out what length of wire to use. You will need to describe the experiment he will need to carry out, any hazards and any variables involved.

(6 marks)

Marked by:_____

Feedback:

Resistance in a wire

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) **Grade 3-4**	Level 2 Clear Understanding (3-4 marks) **Grade 5-6**	Level 3 Detailed Understanding (5-6 marks) **Grade 7-8**
No relevant content	There is a brief description of how to measure resistance in a wire	There is a scientific description of how to work out resistance in a wire including any hazards involved	There is a clear and detailed scientific description of how to measure resistance in a wire and how to use this information to calculate what length of wire will be required for a resistance of 3.2 ohms
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

- Independent variable: length of wire
- Dependent variable: resistance in ohms
- Control variable: Voltage going into the wire, type of wire, room temp, temp of wire
- 1 mark for a simple step by step method missing information out
- 2 marks for a reasonable step by step method
- 3 marks for a detailed step by step method
- The experiment will be repeated 3 times so an average can be taken
- This will increase accuracy
- The resistance will be worked out to more decimal places to increase precision
- Plot results on a graph and read off what length wire gives a resistance of 3.2 ohms

Total 6 marks

GCSE Required Practical – Physics 1 – Investigating Electrical Components (lamp, diode, resistor)

Component: part of a circuit

Current: the flow of charge

diode: only allows current to flow one way

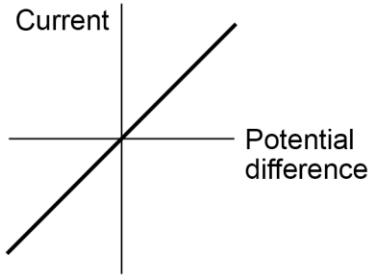
Potential Difference (V): the energy transferred to part of a circuit by each coulomb of charge

Resistor: limits the current in a circuit

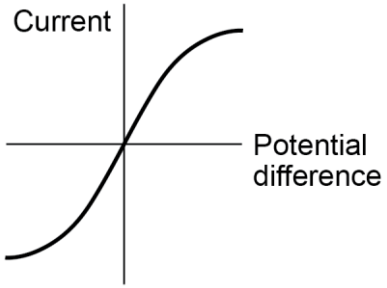
What's the point of the practical?

To find out how current and potential difference change in different components

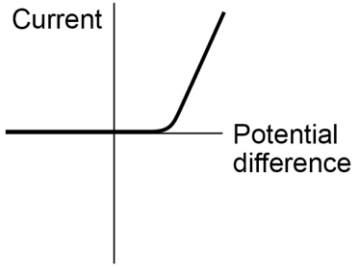
Results:



Resistor



lamp

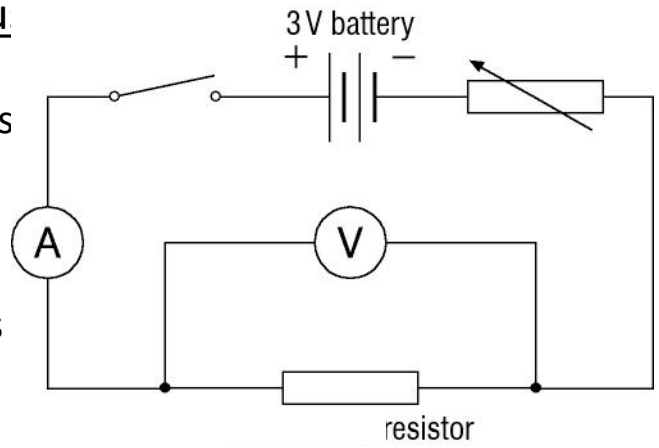


Diode

Example Apparatu

Voltmeter: measures the potential Difference

Ammeter: measures the current



Resistor: what we're testing. (can be replaced with a lamp, then a diode

What may they ask us about?

- Explain the pattern for each component (***resistor***: *fixed resistance – more PD =more current.* ***Lamp:*** *more PD = more current but at high PD, the filament gets hot, ions vibrate so resistance increases and current levels off.* ***Diode***: *current can only flow in one direction)*
- Resolution of measurements, repeatability, reproducibility, control variables etc etc

I-V Characteristics Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate what happens to the current through a component when the pd across it changes. Some of the equipment they were provided with is shown below:

- ammeter and milliammeter, or multimeter
- voltmeter or multimeter
- component holders
- 12 V, 24 W lamp eg a ray box lamp
- resistor
- diode and protective resistor (eg 10 Ω)
- rheostat eg 10 Ω, 5 A

Describe how they could carry out this investigation

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Connect the circuit. It may be helpful to start at the positive side of the battery or power supply. This may be indicated by a red socket.
2. Connect a lead from the red socket to the positive side of the ammeter.
3. Connect a lead from the negative side of the ammeter (this may be black) to one side of the resistor.
4. Connect a lead from the other side of the resistor to the variable resistor.
5. Connect a lead from the other side of the variable resistor to the negative side of the battery. The main loop of the circuit is now complete. Use this lead as a switch to disconnect the battery between readings.
6. Connect a lead from the positive side of the voltmeter to the side of the resistor the ammeter is connected to.
7. Connect a lead from the negative side of the voltmeter to the other side of the resistor.
8. Record the readings on the ammeter and voltmeter in a suitable table.
9. Adjust the variable resistor and record the new ammeter and voltmeter readings. Repeat this to obtain several pairs of readings.
10. Swap the connections on the battery. Now the ammeter is connected to the negative terminal and variable resistor to the positive terminal.
11. Continue to record pairs of readings of current and potential difference with the battery reversed.
12. Continue to record pairs of readings of current and potential difference with the battery reversed.

Total 6 marks

GCSE Required Practical – Physics 1 – Calculating Density

Density = a substance's mass per unit volume.

$$density = \frac{mass}{volume} = \frac{m}{v}$$

What's the point of the practical?

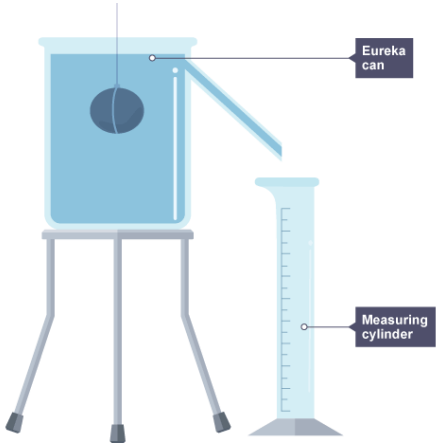
To find out the density of different materials.

Cubes of material are easy for volume (length x width x height). For irregular shapes, you need a eureka can to work out the volume

Results

Material	Mass (g)	Volume (cm^3)	Density (g/cm^3)
Aluminium	22.3	8.0	2.79
Steel	50.2	6.4	7.84

Example Apparatus



Finding Volume

Finding Mass

What may they ask us about?

- What is the resolution of the balance? (*0.1g in this case*)
- How could you get errors when using the eureka can? (*water may spill out of the sides if you drop the object in too quickly / there may already be some water in the measuring cylinder / the water might not be at exactly the level of the spout)*
- How could you get errors when weighing the object (*the balance may not be at exactly zero to start with (not calibrated))*
- What is the uncertainty of the measurements? (the balance has a ±0.05 uncertainty here as it only goes up in 0.1's)

Density Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to identifying a substance from its density. Some of the equipment they were provided with is shown below:

- 30 cm ruler marked off in mm
- digital balance
- regular shaped objects.

Describe how they could carry out this investigation

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. For each object measure the:
   - length
   - width
   - height.
2. Record your results.
   Include columns for volume, mass, density and substance.
   - volume
   - mass
   - density
   - substance.
3. Measure the mass of each object using the digital balance. Record the results.
4. Calculate and record the volumes (length [Symbol] width [Symbol] height).
5. Calculate and record the densities (mass ÷ volume).
6. Use the table below to identify the substance each object is made from.

Total 6 marks

GCSE Required Practical – Physics 2 – Force and extension of a spring

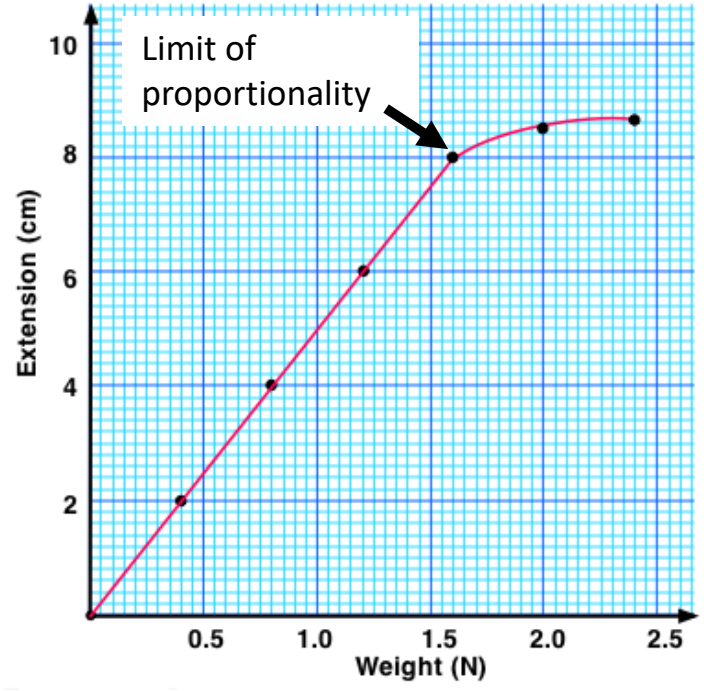
Extension = how much the length has increased from it's original length

What's the point of the practical?

To find out the relationship between force and extension.

Results:

Hooke's Law: extension is directly proportional to the force applied, as long as the limit of proportionality is not exceeded

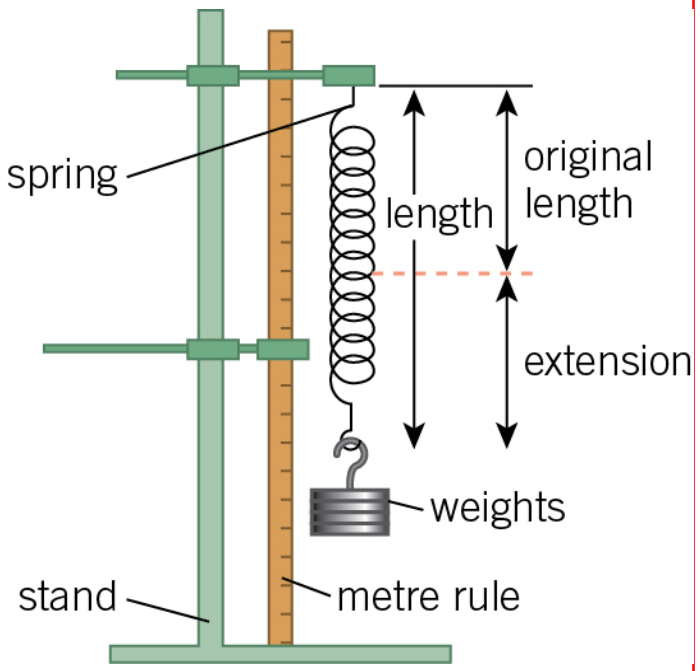


Example Apparatus

Weights – provide a force (N)

Spring - stretches

Metre rule – measures the length of the spring (before and after)



What may they ask us about?

- Describe the relationship (***directly propotional***). Label the **limit of proportionality** (*where it's no longer a straight line*)
- What error could cause the extension to NOT start at zero (*if you measured, the length and not the extension. The **extension** should be zero with no weights, but the **length** of the spring will be a few cm)*
- What is the IV (force), what is the DV (extension), comment on repeatability, resolution, etc

Force and Extension Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to make and calibrate a spring balance (newtonmeter). Some of the equipment they were provided with is shown below:

- a spring
- a metre ruler
- a splint and tape to act as a pointer
- a 10 N weight stack
- a clamp stand, with two clamps and bosses
- a heavy weight to prevent the apparatus tipping over
- a mystery object to weigh.

Describe how they could do this

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) **Grade 3-4**	Level 2 Clear Understanding (3-4 marks) **Grade 5-6**	Level 3 Detailed Understanding (5-6 marks) **Grade 7-8**
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Attach the two clamps to the clamp stand using the bosses. The top clamp should be further out than the lower one.
2. Place the clamp stand near the edge of a bench. The ends of the clamps need to stick out beyond the bench.
3. Place a heavy weight on the base of the clamp stand to stop the clamp stand tipping over.
4. Hang the spring from the top clamp
5. Attach the ruler to the bottom clamp with the zero on the scale at the top of the ruler. If there are two scales going in opposite directions you will have to remember to read the one that increases going down.
6. Adjust the ruler so that it is vertical. The zero on the scale needs to be at the same height as the top of the spring.
7. Attach the splint securely to the bottom of the spring. Make sure that the splint is horizontal and that it rests against the scale of the ruler.
8. Take a reading on the ruler – this is the length of the unstretched spring.
9. Carefully hook the base of the weight stack onto the bottom of the spring. This weighs 1.0 newton (1.0 N).
10. Take a reading on the ruler – this is the length of the spring when a force of 1.0 N is applied to it.
11. Add further weights. Measure the length of the spring each time.

Total 6 marks

GCSE Required Practical – Physics 2 – Force and acceleration

What's the point of the practical?

To find out what happens to the acceleration when we change the mass.
And to find out what happens to the acceleration when we change the force.

Force (N) = mass (kg) x acceleration (m/s^2)

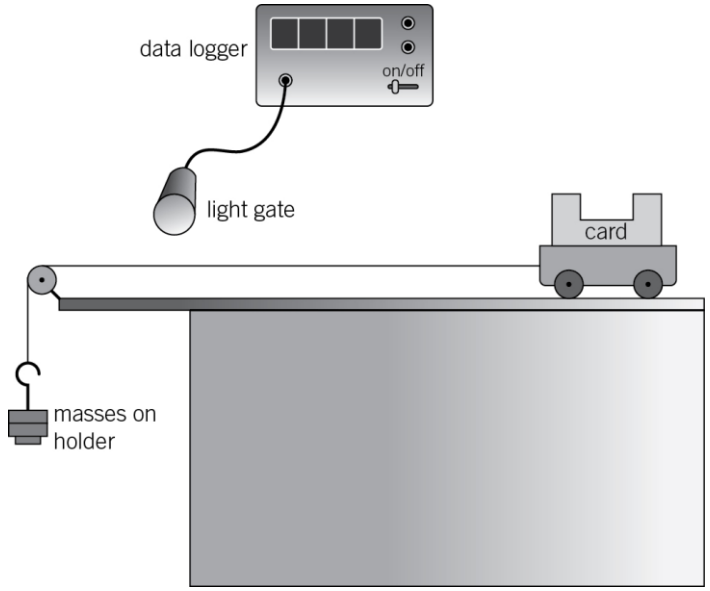
$$\text{Acceleration } (m/s^2) = \frac{\text{change in velocity } (m/s)}{\text{time } (s)}$$

Results:
The more force, the more acceleration.
The more mass, the less acceleration.

Example Apparatus

Data logger and light gate - Measures velocity or acceleration

Masses – make the trolley (car) move

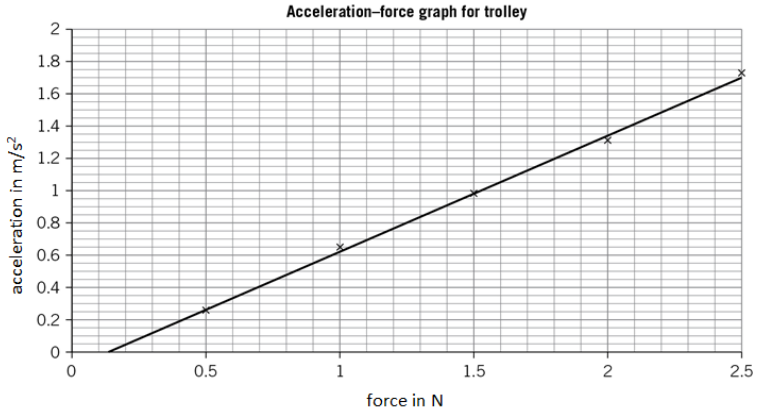


What may they ask us about?

- They may get you to work out acceleration from force and mass (easy) or give you the change in velocity and time so you need to use both equations above.
- State one possible source of error (*friction slows the trolley down, the trolley doesn't go in an exact straight line, the masses hit the floor and stop pulling on the string)*
- What is the IV, DV and control variables for each part of the experiment?

(*remember, if you're changing the mass, the force should stay the same, if you're changing force, the mass should stay the same – only one thing changes)*

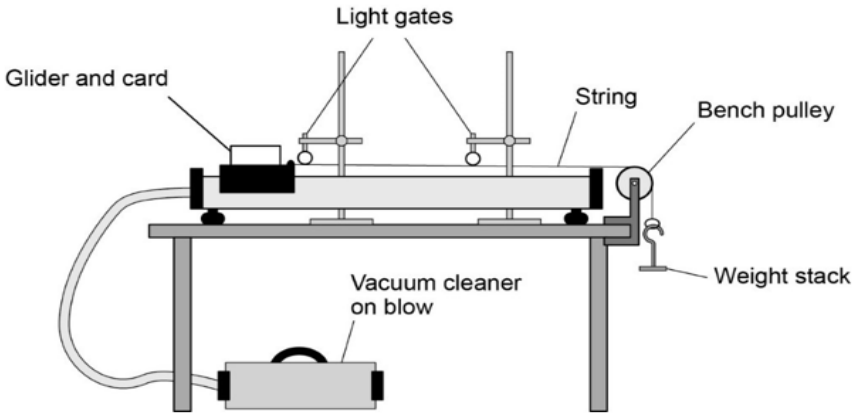
- Interpret graphs of results and use them to calculate or make predictions:



Acceleration Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigating acceleration using an air track and light gates. The diagram below shows how the equipment can be set up:



Describe how they could carry out this investigation

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Place a glider on the air track and switch on the vacuum cleaner. The glider should lift up off the air track and be free to move.
2. Connect the light gates to the interface and computer. Start the software for timing.
3. Attach the bench pulley to the end of the air track away from the vacuum cleaner.
4. Tie a length of string to the glider. Pass the string over the pulley and attach the weight stack to the other end of the string.
5. Switch on the vacuum cleaner. The glider should accelerate through the light gates as the weight falls to the ground.
6. The first experiment will investigate how the acceleration depends upon the force. The force is provided by the weight stack.
   - Attach the full weight stack (1 N) to the end of the string.
   - Switch on the software.
   - Make sure the glider is in position and switch on the vacuum cleaner.
   - The glider should accelerate through the light gates towards the bench pulley.
   - Record the acceleration. Repeat.
   - If the two values are not similar, repeat again.
   - Record your readings in a table such as the one below. Calculate the mean.

GCSE Required Practical – Physics 2 – Waves in a tank (water)

Wave speed (m/s) = frequency (Hz) x wavelength (m)

What's the point of the practical?

To find out how wavelength, frequency and wave speed are related.

Results:

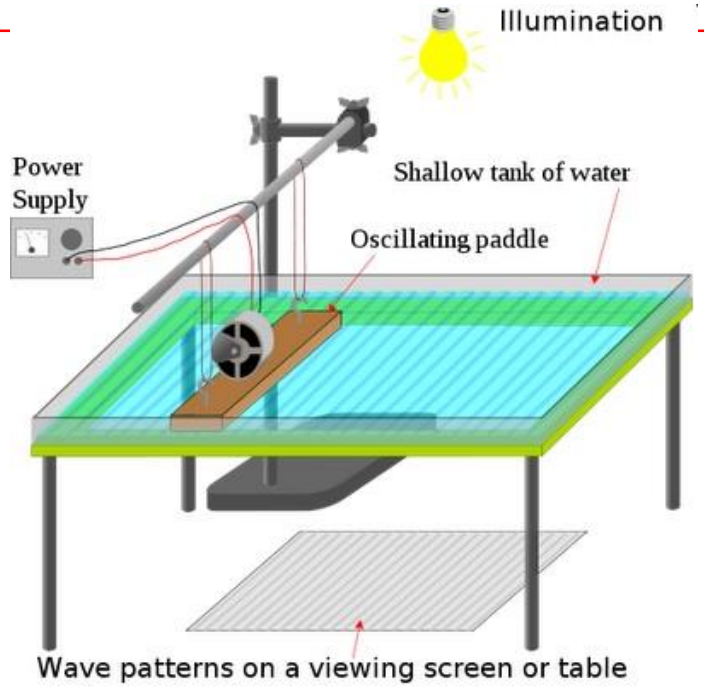
Speed = frequency x wavelength.

If you double the double the frequency, the wavelength is halved and vice versa.

Wave **speed stays the same** because it's always the same material (string)

Example Apparatus

Oscillating paddle – moves up and down to produce waves



What may they ask us about?

- Explain why the wave speeds you calculate are all about the same but **not identical.** (*Wave speed is the same in water but it's hard to be 100% accurate with measurements each time because it's hard to see where exactly the waves are, the waves keep moving, some waves are reflected)*
- How could you improve the accuracy of measurements? (add insulation to stop reflected waves, use a bigger pool, brighter light, sharper paddle to get nice clean waves)
- Comment on repeatability, reproducibility, range, uncertainty and calculate means

Waves Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. Some of the equipment they were provided with is shown below:

- ripple tank plus accessories
- suitable low voltage power supply
- metre ruler.

Describe how they could carry out this investigation

(6 Marks)

Waves Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Set up the ripple tank. A large sheet of white card or paper needs to be on the floor under the tank.
2. Pour water to a depth of about 5 mm into the tank.
3. Adjust the height of the wooden rod so that it just touches the surface of the water.
4. Switch on both the overhead lamp **and** the electric motor.
5. Adjust the speed of the motor. Low frequency water waves need to be produced.
6. Adjust the height of the lamp. The pattern needs to be clearly seen on the card on the floor.
7. Place a metre ruler at right angles to the waves shown in the pattern on the card. Measure across as many waves as possible. Then divide that length by the number of waves. This gives the **wavelength** of the waves.
8. Count the number of waves passing a point in the pattern over a given time (say 10 seconds). Then divide the number of waves counted by 10. This gives the **frequency** of the waves.
9. Calculate the speed of the waves using the equation:

wave speed = frequency [Symbol] wavelength

Total 6 marks

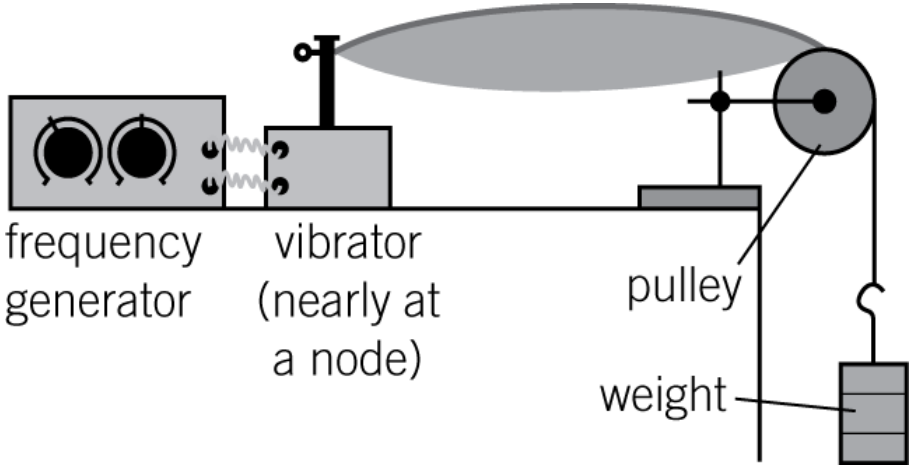
GCSE Required Practical – Physics 2 – Waves in a solid (string)

Wave speed (m/s) = frequency (Hz) x wavelength (m)

What's the point of the practical?
To find out how wavelength, frequency and wave speed are related.

Results:
Speed = frequency x wavelength.
If you double the double the frequency, the wavelength is halved and vice versa.
Wave **speed stays the same** because it's always the same material (string)

Example Apparatus



Weight – hold the String tight (taut)

Frequency generator and vibrator (oscillator) – make the string vibrate to produce waves.

What may they ask us about?
How could you measure the waves more accurately? (*use a different colour or width string to make it easier to see the waves)*
Comment on repeatability, reproducibility, uncertainty and calculate means

GCSE Required Practical – Physics 2 – Surfaces and radiation

Infrared Radiation: electromagnetic waves that heat things up. Emit: when something **gives off** something

Absorb: when something takes in or soaks up something (don't say attract!)

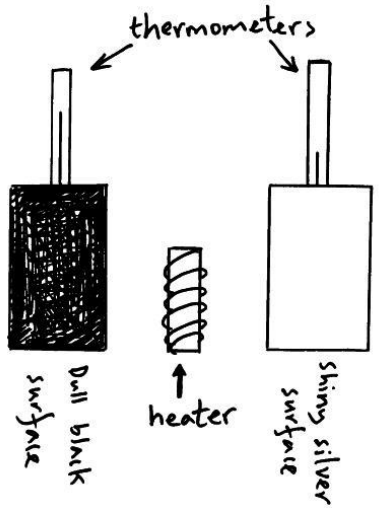
What's the point of the practical?

To find out how the colour and texture of the surface affects how much heat (radiation) is absorbed or emitted

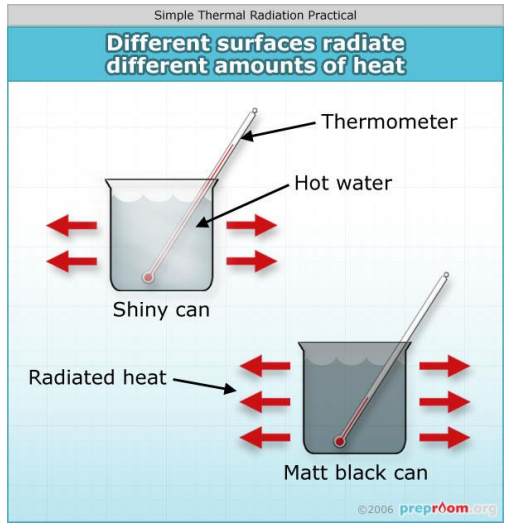
Results:

Matt black surfaces **absorb** and **emit** much more radiation than shiny smooth surfaces.

Example Apparatus



Heated from the outside



Heated from the inside

What may they ask us about?

- Independent, dependent and control variables (*same sizes, same volumes, same thickness, starting temp etc*)
- Why should you put lids on each container (*to reduce heat loss through convection)*
- Resolution of measurements *(1°C?),* repeatability, reproducibility, calculating means etc
- Why won't you get exactly the same measurements if you repeat the experiment? What are the sources of error? (*hard to read the temp at exactly the right time, slightly different volumes, slightly different starting temperatures, can may be warm already)*

Radiation and Absorption Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the amount of infra-red radiation emitted by different surfaces. Some of the equipment they were provided with is shown below:

- Leslie cube kettle
- infrared detector
- heat proof mat..

Describe how they could carry out this investigation

(5 Marks)

Radiation and Absorption Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Place the Leslie cube on to a heat proof mat.
2. Fill the cube with very hot water and replace the lid of the cube.
3. Use the detector to measure the amount of infrared radiated from each surface.
4. Make sure that before a reading is taken the detector is the same distance from each surface.
5. Draw a bar chart to show the amount of infrared radiated against the type of surface.

Total 5 marks

Triple Only

Growing Bacteria

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The student is told to grow some bacteria on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of bacterium in the Petri dish

You should explain the reasons for each of the steps you describe

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
No relevant content	There is a brief description of how to grow bacteria	There is an attempt to explain speciation which shows an understanding of how to grow viable bacteria	There is a clear and detailed explanation of how bacteria can be grown on an agar plate
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of biology points made in the response

- Set up a Bunsen burner to kill any bacteria in the air around where you are working
- Only work with the petri dish under the Bunsen burner flame
- Using a sterile pipette take out some (amount in ml) of bacteria from a sample
- Squirt the sample onto the agar
- Dip the spreader into some ethanol (alcohol) and burn it off to kill any bacteria on it
- Spread the bacteria around the plate evenly
- Seal the plate in 4 places using tape
- Put a label on it indicating what it is and when it was spread
- Incubate the plate for 3 days
- Serialise used equipment

Total 6 marks

Triple Only

Germination Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to Investigate the effect of light intensity on the growth of mustard seedlings. Some of the equipment they were provided with is shown below:

- white mustard seeds
- petri-dishes
- cotton wool
- a ruler
- water
- access to a light windowsill and a dark cupboard.

Describe how they could carry out this investigation

Germination Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of biology points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Set up three petri dishes containing cotton wool soaked in equal amounts of water.
2. Put ten mustard seeds in each petri dish.
3. Put the petri dishes in a warm place. They must **not** be disturbed or moved.
4. Allow the mustard seeds to germinate. Add more water if the cotton wool gets dry (equal amounts of water to each petri dish).
5. Each petri dish should have the same number of seedlings after the seeds have geminated. Remove excess seedlings from any dish that has too many.
6. Move the petri dishes into position.
   - One should be placed on a windowsill in full sunlight.
   - One should be placed in partial light.
   - The third should be placed in darkness
7. Measure the height of each seedling. Do this every day, for **at least** a week.
8. Calculate the mean height of the seedlings each day

Total 6 marks

Triple Only

Flame Test Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to carry out an investigation into what an unknown ion is using a flame test. They were provided with the equipment below

- Bunsen burner
- nichrome wire mounted in handle
- Known labelled solutions: chlorides of lithium, sodium, potassium, calcium and copper
- salt solution labelled 'unknown'

Describe how they could carry out this investigation

Flame Test Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of chemistry points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Pour around 1 cm depth of each of the **labelled chloride solutions** into five test tubes in the rack.
2. Dip the nichrome wire into the first solution. Then hold the tip of the wire in a blue Bunsen burner flame.
3. Record your observation (colour of the flame)
4. Clean the wire carefully.
5. Repeat steps **2–4** for each of the other four solutions.
6. Compare the colour of the unknown to the colours of the known ions to see what it is

Total 6 marks

Triple Only

Titrations

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Bernard is given instructions to carry out the titration labelled '1st titration'.
His instructions say:

- clean a pipette with water and then rinse it with sodium hydroxide solution
- clean a burette with water and then rinse it with dilute hydrochloric acid
- use the pipette to transfer 25 cm3 of sodium hydroxide solution into a conical flask
- add a few drops of acid-base indicator
- fill the burette with dilute hydrochloric acid and take the reading on the burette
- add hydrochloric acid from the burette to the alkali in the conical flask, swirling the contents all the time
- add the acid drop-by-drop near the end-point until the colour changes
- take the final burette reading.

Explain why these steps help to ensure that Bernard's results are accurate

(6 marks)

Titrations

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) **Grade 3-4**	Level 2 Clear Understanding (3-4 marks) **Grade 5-6**	Level 3 Detailed Understanding (5-6 marks) **Grade 7-8**
No relevant content	A brief explanation of how the method would give good results	A good explanation explaining how most of the stages would help give good results	A good explanation explaining how all of the stages would help give good results
	• Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak	• Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors.	• Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar

Examples of Chemistry points made in the response

an explanation including some of the following:

- apparatus rinsed to ensure that the concentrations are not affected by
- any other substances that might interfere with the results
- using a pipette increases accuracy
- the conical flask is used because it allows swirling without spilling
- an indicator to determine the end point of the titration precisely
- the initial reading enables Bernard to know how much acid was in the burette at the start
- swirling ensures that the reactants mix/react together
- drop-by-drop ensures an accurate value for the volume of acid needed
- the colour change occurs when just enough alkali has been added to react with all the alkali
- taking the final burette reading enables the volume of acid used to be calculated

Total 6 marks

Triple Only

Light Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to see what happens to the direction of light after hitting the surface of different materials. Some of the equipment they were provided with is shown below:

- ray box
- suitable power supply
- a slit and lens that fit the ray box and can be used to make a narrow ray
- two rectangular transparent blocks of different materials eg glass, Perspex
- 30 cm ruler
- Protractor
- sheets of plain A3 paper

Describe how they could carry out this investigation

(6 Marks)

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

- Set up the ray box, slit and lens so that a narrow ray of light is produced. Then darken the room.
- Place the ruler near the middle of the A3 paper and draw a straight line parallel to its long side
- Use the protractor to draw a second line at right angles to this line.
- Label this line with an 'N' for 'normal'
- Draw around the transparent block. Be careful **not** to move it.
- Use the ray box to direct a ray of light at the point where the normal meets the block.
- This is called the '**incident ray**'.
- The angle between the normal and the incident ray is called '**the angle of incidence**'.
- Mark the path of the reflected ray with another cross.
- Mark the path of the ray that leaves the block (the transmitted ray) with two crosses. One cross needs to be near the block and the other cross further away.
- Draw the incident ray by drawing a line through your first cross to the point where the normal meets the block.
- Draw the reflected ray by drawing a line through your second cross to the point where the normal meets the block.
- Draw the transmitted ray by drawing a line through the two crosses on the other side of the block to that side of the block. Label this point with a 'P'.
- Draw a line that represents the path of the transmitted ray through the block.

Total 6 marks

Triple Only

Thermal insulation Required Practical

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the effectiveness of different materials as thermal insulators. Some of the equipment they were provided with is shown below:

- large beaker eg 800 ml
- small beaker eg 250 ml
- thermometer
- kettle to heat water
- piece of cardboard
- large beaker eg 800 ml
- small beaker eg 250 ml
- thermometer
- kettle to heat water
- piece of cardboard scissors
- stop clock
- selection of insulating materials, eg polystyrene granules, sawdust, bubble wrap, newspaper.

Describe how they could carry out this investigation

Thermal insulation Required Practical

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

Poor Understanding (0 marks)	Level 1 Basic Understanding (1-2 marks) Grade 3-4	Level 2 Clear Understanding (3-4 marks) Grade 5-6	Level 3 Detailed Understanding (5-6 marks) Grade 7-8
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Examples of physics points made in the response

When marking this question, the amounts do not need to be the same, however, the method should follow roughly the same steps

1. Use the kettle to boil water. Put 80 ml of this hot water into a small beaker.
2. Put the small beaker inside the large beaker.
3. Use a piece of cardboard as a lid for the large beaker. The cardboard must have a hole for the thermometer.
4. Insert the thermometer through the hole in the cardboard lid so that its bulb is in the hot water.
5. Record the temperature of the water and start the stopwatch.
6. Record the temperature of the water every 5 minutes for 20 minutes.
7. Repeat steps **1–6** using the different materials each time to fill the space between the small and large beaker.

Total 6 marks