Transition Pack

AAQ Applied Science

A guide to help you get ready for AAQ Applied Science courses.

This pack contains a programme of activities and resources to prepare you to start AAQ Applied Science in September. It is aimed to be used after you complete your GCSE throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.

RECOMMENDED READING/WATCH LIST
Summer Reading/Watchlist Optional Tasks
• "The Science Book" by DK – a visual guide to scientific breakthroughs. • "Stuff Matters" by Mark Miodownik – explores the science behind everyday materials. • Watch: BBC's "The Secret Life of the Laboratory" (YouTube or iPlayer)

SUMMER WORKING TASK INFORMATION
Completion Date: First Lesson Week Commencing 7/9/26
This pack will help you make the best possible start to studying this subject. The tasks in this pack should take you about 4-6 hours to complete. The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at aburgon@hbk.acesmat.uk telling us which Getting Ready For pack you are working on and what help you need.

Contents:

Includes:

a) Math Skills
b) Biology Tasks
c) Chemistry Tasks
d) Physics Tasks

PART A – Maths Skills

	Complete the following tasks:
Task 1	**Symbols and Prefixes**
Task 2	**Significant figures** At level 3 you will be expected to use an appropriate number of significant figures in your answers. The number of significant figures you should use is the same as the number of significant figures in the data you are given. You can never be more precise than the data you are given so if that is given to 3 significant your answer should be too. E.g. Distance = 8.24m, time = 1.23s therefore speed = 6.75m/s

Metric prefix	Symbol	Number	Power of 10
giga	G	1,000,000,000	10^{9}
mega	M	1,000,000	10^{6}
kilo	k	1,000	10^{3}
centi	c	0.01	10^{-2}
milli	m	0.001	10^{-3}
micro	μ	0.000001	10^{-6}
nano	n	0.000000001	10^{-9}

Task 1:

Solve the following:

1. How many metres in 2.4 km? _____
2. How many joules in 8.1 MJ? _____
3. Convert 326 GW into W. _____
4. Convert 54 600 mm into m. _____
5. How many grams in 240 kg? _____
6. Convert 0.18 nm into m. _____
7. Convert 632 nm into m. Express in standard form. _____
8. Convert 1002 mV into V. Express in standard form. _____

9. How many eV in 0.511 MeV? Express in standard form. _____

10. How many m in 11 km? Express in standard form._____

Task 2:

Give the following to 3 significant figures:

1. 3.4527

2. 40.691

3. 0.838991

4. 1.0247

Calculate the following to a suitable number of significant figures:

1. 63.2 ÷78.1 =

2. 39 + 78 + 120 =

3. (3.4+3.7+3.2) ÷3 =

4. 0.0256 x 0.129 =

PART B – Biology

	Complete the workbook covering all the following tasks:
Task 1	**Worksheet 1: Cell Structure and Function** Familiarity with the structure and function of cells is essential. If you need help completing this activity, GCSE bitesize revision is helpful: https://www.bbc.co.uk/bitesize/guides/z84jtv4/revision/7
Task 2	**Worksheet 2: Microscopy** Prior experience with light microscopes and the ability to identify basic structures in photomicrographs is essential. If you need help completing this activity, take a look at this website: https://www.bbc.co.uk/bitesize/guides/z84jtv4/revision/1
Task 3	**Worksheet 3: Cellular Transport** A working definition of diffusion, osmosis (moving from high to low concentration), and active transport is expected. Here are some BBC bitesize notes to help you answer the questions: https://www.bbc.co.uk/bitesize/guides/zs63tv4/revision/4
Task 4	**Worksheet 4: Biological Systems** You should understand that tissues are groups of similar cells working together. You also need to know the basic roles of the xylem and phloem, the function of root hair cells, and the structure of stomata in plants. Here is a video to help: https://youtu.be/8UAl5C2frNQ
Task 5	**Worksheet 5: Macronutrients and Genetics** A basic understanding of carbohydrates, lipids, and proteins as macronutrients, along with the concept of DNA as genetic information responsible for inheritance, is required. See the following for more information: Different food types - nutrients, water and fibre - Diet and nutrition - AQA - GCSE Physical Education Revision - AQA - BBC Bitesize and Genetic inheritance - Genetic inheritance - AQA - GCSE Combined Science Revision - AQA Trilogy - BBC Bitesize

Worksheet 1 – Cell Structure and Function

Part A: Cell Structure

Draw a typical animal cell and a typical plant cell. Label the nucleus, cytoplasm, cell membrane, ribosomes, cell wall, chloroplasts, and mitochondria.

Animal Cell
Plant Cell

Part B: Cell Function

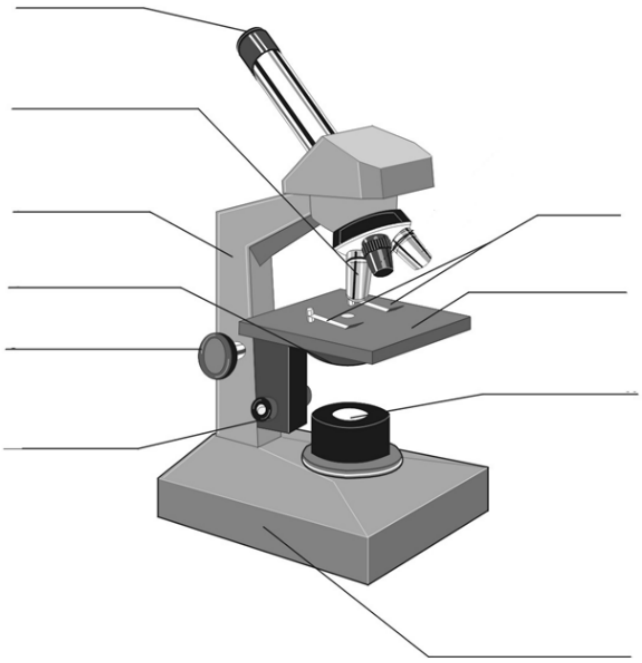
Define the function of each organelle.

Organelle	**Function**
Nucleus	
Cytoplasm	
Mitochondria	
Ribosomes	
Cell membrane	
Cell wall	
Chloroplasts	
Vacuole	

Worksheet 2 - Microscopy

Part A: Anatomy of the Light Microscope

1. Label and state the function of each part.



Part B: The Art of the Temporary Mount

1. You need to prepare a temporary, stained mount of onion epidermis cells to view under a light microscope. Place the following steps in the correct chronological order:

Gently lower the coverslip at a 45° angle to avoid air bubbles.	
Place a small biological sample on a clean glass slide.	
Use the coarse focus to locate the cells at low power (x10).	
Add one drop of iodine stain to the sample to enhance contrast.	
Switch to the high-power objective lens (x40) for detailed observation.	

Part C: Size and Scale (Mathematical Foundations)

1. Unit Conversions: In Level 3 Applied Science, you must be able to convert between units fluently. Complete the following:
    - 5 mm = _____ µm
    - 450 µm = _____ mm
    - 0.2 µm = _____ nm
2. Using the equation *Magnification = Image size ÷ Actual size*, solve the following:
    - A student observes a mitochondrion in a photomicrograph. The image size (observed size) is 20 mm, and the magnification used is x10,000. Calculate the actual size of the mitochondrion in micrometers (µm).

_____

_____

_____

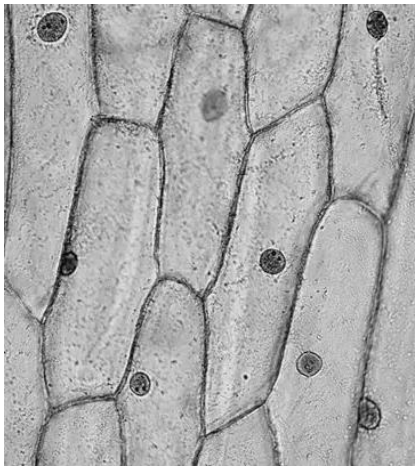
_____

_____

Actual size = _____ µm

Part D: Interpreting the Micrograph

1. Biological Drawing: Look at a high-resolution photomicrograph of a plant cell.



Produce a formal biological drawing of this cell following these rules:

- Use a sharp HB pencil and clear, continuous lines (no "sketching" or feathering).
- Do not use any shading or stippling.
- Ensure all label lines are horizontal and do not have arrowheads.
- Label the following visible ultrastructures: Cell Wall, Nucleus, Vacuole, and Chloroplasts.
- Include a title and the calculated magnification

Worksheet 3 – Cellular transport

Part A: Transport methods

1. Complete the table below to compare the four primary methods of movement across a cell membrane.

Feature	Simple Diffusion	Facilitated Diffusion	Osmosis	Active Transport
Energy Required? (ATP)				
Direction of Flow	High to Low			
Protein Involved? (None / Channel / Carrier)				
Example Substance				

Part B: Osmosis and Water Potential

1. Terminology Shift: At GCSE, you likely defined osmosis as the movement of water from a "high water concentration to a low water concentration." In Year 12, we use water potential (ψ).
    - Rewrite the definition: Provide a formal definition of osmosis using the terms: *water potential*, *net movement*, and *partially permeable membrane*.

    - Application: If a cell with a low water potential is placed in a solution with a high-water potential, describe the direction of water movement and the resulting effect on the cell's appearance.

Part C: Applied Science Thinking

1. Bioenergetics: Active transport requires a constant supply of ATP.
    - Based on your knowledge of cell ultrastructure, explain why root hair cells in plants and sperm cells in animals contain an abundance of mitochondria.

    - Critical Thinking: Why would water-logged soil (which lacks oxygen) cause a plant to suffer from a deficiency in mineral ions, even if the ions are present in the soil?

Worksheet 4 – Biological Systems

Part A: Roots and Resource Acquisition

1. Specialisation of the Root Hair Cell:
    - Draw and label a root hair cell.

- Explain how the structure of this cell is adapted for its role. Your answer must mention surface area and the role of the cell membrane in active transport.

- Why do root hair cells contain an abundance of mitochondria, and why would water-logged soil (which lacks oxygen) hinder a plant's ability to take up minerals?

Part B: Leaf Gas Exchange and Stomata

1. Identify the specialised cells that control the opening and closing of stomata.

2. Advanced Reasoning: These cells are unique among epidermal cells because they contain chloroplasts. Explain the significance of these chloroplasts in regulating the opening of the pore for gas exchange.

Part C: Vascular Logistics (Xylem vs. Phloem)

1. Complete the table below to contrast the two main transport systems in plants.

Feature	**Xylem**	**Phloem**
Substance Transported		
Direction of Flow		
Process Name		
Cell Status		
Structural Feature		

Worksheet 5 – Macronutrients and Genetics

Part A: The Building Blocks (Monomers to Polymers)

Complete the table below to identify the repeating units that build life.

Macronutrient	**Monomer (Building Block)**	**Polymer (Large Molecule)**	**Type of Bond Formed**
Carbohydrate			
Protein			
Lipid			
Nucleic Acid			

Part B: Food tests

Recalling your GCSE required practicals, describe the positive result and the specific method for identifying the following substances. You will use these same tests in Unit F180 to identify unknown compounds.

1. Starch: Identify the reagent used and the colour change for a positive result.

2. Reducing Sugars (e.g., Glucose): Explain why this test requires a water bath and state the colour of a "high concentration" result.

3. Proteins: Name the test and the colour change for a positive result.

4. Lipids: Describe the Emulsion Test—what is added to the sample and what indicates a positive result?

Part C: Genetics

1. Base Pairing: State the four nitrogenous bases in DNA and identify which bases pair together. Why is this "complementary" pairing vital for the integrity of the genetic code?

2. Define a mutation. Explain why a mutation in a DNA sequence is not always considered a negative event for an organism.

Part D: Applied Thinking (Macronutrient Myths)

Using your research skills, write one paragraph to debunk the following common misconceptions:

- Myth 1: "Carbohydrates are just simple sugars that provide instant energy." (Hint: Think about the structural role of cellulose in plants).
- Myth 2: "All lipids are unhealthy and should be avoided in a balanced diet." (Hint: Think about phospholipids in the cell membrane and the myelin sheath in neurons)

PART B – Chemistry

	Complete the workbook covering all the following tasks:
Task 1	**Worksheet 1: Atomic Structure** Recalling GCSE Chemistry, you should know the definition of an atom, the history of atomic theory, and the discovery of the three subatomic particles (protons, neutrons, electrons).
Task 2	**Worksheet 2: Periodic Table** GCSE knowledge of how elements are organized by atomic number and the general reactivity trends of Group 0, Group 1, and Group 7 is necessary.
Task 3	**Worksheet 3: Writing chemical formula** Understanding how to write chemical formula is vital for success in chemistry. You may find this video helpful: https://www.youtube.com/watch?v=Urc75hoKGL
Task 4	**Worksheet 4: Bonding and Matter** You should have covered the different types of substances – metallic, ionic, simple covalent, giant covalent and monatomic in GCSE Science. These are some bbc bitesize notes to help you answer the questions: https://www.bbc.com/bitesize/guides/zjfkw6f/revision/1

Worksheet 1: Atomic Structure

Part A: Defining the Building Blocks

1. Provide a Year 12 level definition of an atom.

2. Complete the table below regarding the three fundamental subatomic particles.

Particle	Relative Mass	Relative Charge	Position in the Atom
Proton			
Neutron			
Electron			

Part B: The History of the Model (Experimental Evidence)

In 1911, Ernest Rutherford conducted the famous gold foil experiment.

- Briefly describe the results of this experiment.
- Explain how these results disproved the "Plum Pudding" model and led to the discovery of the dense central nucleus.

Part C: The Bohr Model

1. The specification requires you to accurately represent atoms using the Bohr model up to Atomic Number (Z) = 20.
    - Draw the electron configuration for Sodium (Z=11) and Calcium (Z=20).

- Identify the number of protons, neutrons, and electrons in an atom of Phosphorus (use your periodic table for mass and atomic numbers).

Part D: Critical Thinking

1. The Bohr model (electrons in concentric circles) is an oversimplification.
    - Research and explain why the Bohr model is limited (Hint: It works well for "hydrogen-like" atoms but fails for more complex ones).

    - What is the name of the more advanced model that uses orbitals instead of fixed circular paths?

Worksheet 2: The Periodic Table

Part A: The Modern Layout

1. The modern Periodic Table organizes elements in order of increasing atomic (proton) number. Explain how this differs from earlier versions of the table, such as Mendeleev's, which were primarily based on atomic mass.

2. Groups and Periods:
    - Define a Group and explain what elements in the same group have in common regarding their chemical properties.

    - Define a Period and describe the general trend in atomic number as you move from left to right across a period.

Part B: Group 1 – The Alkali Metals

1. The Reactivity Trend: Recall the reaction of alkali metals (like Sodium or Potassium) with water.
    - Describe the trend in reactivity as you move down Group 1.

Part C: Group 7 – The Halogens

1. The Opposite Trend: Contrast the Halogens with the Alkali Metals.
    - Describe the trend in reactivity as you move down Group 7.

Part D: Group 0 – The Noble Gases

1. The Inert Exception:
    - Explain why Group 0 elements are generally unreactive (inert) in terms of their electron configuration.

Worksheet 3: Chemical formulae

Part A: Anatomy of an Equation

1. Define the following terms in the context of a chemical reaction:
    - Reactant: _____
    - Product: _____

Part B: Formulae Memory Bank

In the F180 module, you are expected to know the formulae for common acids and alkalis by heart to solve neutralisation problems. Fill in the missing information below:

Name	**Chemical Formula**
Hydrochloric acid	
Sulfuric acid	
Nitric acid	
Ethanoic acid	
Sodium hydroxide	
Ammonia	

Part C: Balancing equations

According to the Law of Conservation of Mass, no atoms are lost or made during a chemical reaction. Therefore, the number of atoms for each element must be the same on both sides of the equation.

Balance the following equations (some may already be balanced):

1. Mg + O_2 → MgO
2. H_2 + Cl_2 → HCl
3. CH_4 + O_2 → CO_2 + H_2O
4. NaOH + H_2SO_4 → Na_2SO_4 + H_2O

Part D: The Significance of State Symbols

Match the symbol to its correct meaning:

- (s) Aqueous
- (l) Liquid
- (g) Solid
- (aq) Gas

Worksheet 4: Bonding and Matter

Part A: The Octet Rule and Atomic Stability

1. Define the octet rule in terms of electrons.

2. Draw the Bohr model for Neon and Argon. Explain why these elements are chemically inert (unreactive) based on their electron configurations.

3. For the following atoms, state whether they will lose, gain, or share electrons to achieve a stable octet:
    - Magnesium (Group 2) _____
    - Oxygen (Group 6) _____
    - Chlorine (Group 7) _____

Part B: Interactions and States of Matter

Use your prior knowledge to complete the following:

1. State what happens to the interactions between particles in a substance at the following points:
    - The Melting Point: Are interactions broken or weakened? _____
    - The Boiling Point: Are interactions broken or weakened? _____

2. If Substance A has a melting point of 801°C (e.g., Sodium Chloride) and Substance B has a melting point of -182°C (e.g., Methane), what does this tell you about the strength of the electrostatic attractions between their particles?

Part C: Visualizing Structures

1. Sketch a giant ionic lattice of NaCl.

2. Describe the structure of a metal and explain why this structure allows metals to be malleable (hammered into shape). Draw a diagram to help explain.

PART C – Physics

	Complete the workbook covering all the following tasks:
Task 1	**Worksheet 1: Energy Principles** You should be able to apply the Law of Conservation of Energy to complex systems, differentiate between energy stores and carriers, and demonstrate proficiency in scale Sankey diagrams. Useful information can be found here: Energy - GCSE Physics (Single Science) - BBC Bitesize
Task 2	**Worksheet 2: Forces and Motion** A basic understanding that forces are pushes or pulls measured in Newtons (N) is required, along with familiarity with gravity, friction, and tension. Useful information can be found here: Motion and forces - GCSE Physics (Single Science) - BBC Bitesize
Task 3	**Worksheet 3: Circuit Fundamentals** To master standard circuit symbology, differentiate between conventional current and electron flow, and apply Ohm's Law to qualitative and quantitative scenarios. You may find videos in this playlist helpful: Forces - GCSE Physics (Single Science) - BBC Bitesize

Worksheet 1: Energy Principles

Part A: The Conservation Foundation

1. Provide a definition of Energy (Hint: reference "work").

_____

_____

2. State the Law of Conservation of Energy. If energy cannot be destroyed, explain what happens to the "missing" energy when a machine is not 100% efficient.

_____

_____

_____

_____

3. Classify the following into stores or pathways:
   Kinetic, Mechanical, Thermal, Radiation, Chemical, Electrical, Electrostatic, Heating.
   - Stores: _____
   - Pathways: _____

Part B: Mapping Energy Transfers

For the following scenarios, identify the initial energy store, the transfer pathway, and the final useful energy store:

1. A battery-powered toy car climbing a ramp:
   - Initial Store: _____ Pathway: _____ Final Useful Store: _____
2. An electric kettle boiling water:
   - Initial Store: _____ Pathway: _____ Final Useful Store: _____

Part C: Visualising Efficiency (Sankey Diagrams)

A key skill in F180 is drawing Sankey diagrams to represent energy movement.

An industrial motor has a total energy input of 500 J. 350 J is transferred usefully to the kinetic store. 150 J is dissipated as thermal energy to the surroundings.

Task: Draw a Sankey diagram for this motor. Use a scale of 1 cm = 50 J. Ensure your "useful" arrow points forward and your "wasted" arrow points downward.

Part D: Work and Power

1. A scientist applies a force of 120 N to move a piece of lab equipment 5 metres across a floor. Use the formula $W = F\,s$ to calculate the work done in Joules (J).

Work done = _____ J

2. If the scientist moved the equipment in 10 seconds, calculate the Power (W) generated using the formula $P = W \div t$

Power = _____ W

Worksheet 2: Force and Motion

Part A: The Language of Forces

1. Define what a force is.
    - Explain why representing a force with an arrow is a perfect mathematical model (Hint: think about what the length and direction of the arrow represent).

2. Define the following forces as they are used in the F180 specification. For each, state if it is a contact or non-contact force:
    - Weight:
    - Friction:

- Tension:

- Normal Contact Force:

Part B: Free-Body Diagrams

A critical skill in Year 12 is using free-body force diagrams to solve problems. Produce a clear, labelled diagram for the following two scenarios.

Follow these rules: Use a single dot or box to represent the object, and ensure arrows start *from* the object and point *away* in the direction of the force.

1. Scenario 1: A wooden crate sitting stationary on a flat laboratory floor.

2. Scenario 2: A toy car being pulled across a carpet by a horizontal string at a constant velocity. (Note: Consider both the pull and the resistance).

Part C: Newton's Laws – The Conceptual Bridge

1. State Newton's First Law. Using this law, explain why a passenger in a car jerks forward when the driver suddenly hits the brakes.

2. Explain why a net force of zero does not necessarily mean an object is stationary.

Part D: Mathematical Application (Newton's Second Law)

In Year 12, you must fluently use the equation Net Force (N) = mass (kg) × acceleration (m s^{-2}).

1. A scientist applies a force to a lab trolley with a mass of 800g. The trolley accelerates at 2.5 m s^{-2}.
    - Step 1: Convert the mass into the SI base unit (kg).

    - Step 2: Calculate the net force acting on the trolley in Newtons (N).

2. Weight vs. Mass: Using the formula $W = mg$ (where g = 9.81 m s^{-2}), calculate the weight of a 55kg student on Earth. Explain why your mass would stay the same on the Moon, but your weight would change.

Worksheet 3: Circuit Fundamentals

Part A: The Language of Circuits

1. Symbol Mastery: In your transition to Level 3, you must use standardized symbols to communicate complex circuit designs. Draw the correct symbol for each of the following components:

Component	**Drawing**	**Component**	**Drawing**
Single cell		Battery of cells	
Fixed Resistor		Variable Resistor	
Diode		LED (Light Emitting Diode)	
Voltmeter		Ammeter	
Thermistor		LDR (Light-Dependent Resistor)	

Part B: Flow and Potential

1. Define electric current as the flow of charge and explain why the current remains the same at all points in a single-loop series circuit.

2. Explain the historical difference between conventional current (positive to negative) and the actual electron flow (negative to positive).

3. Define potential difference in terms of work done per unit charge.

4. Why is a voltmeter always connected in parallel with a component rather than in series?

Part C: Mathematical Foundations (Ohm's Law & Power)

1. Resistance Calculation: A component has a potential difference of 12V across it and a current of 0.5A flowing through it. Use the formula $V = I R$ to calculate its resistance (Ω).

Resitance = _____ Ω

2. Charge Movement: If a current of 2A flows through a circuit for 30 seconds, calculate the total charge (Q) that has moved through the wire using $Q = I t$.

Total charge = _____ Q

3. Power Dynamics: An electric heater is labelled 230V and 10A. Calculate the power (P) in Watts (W) using $P = I V$.

Power = _____ W

Part D: Series vs. Parallel

1. Kirchhoff's Foundations:
    - In a Series Circuit: Describe what happens to the total resistance as you add more resistors in a single loop.
    - In a Parallel Circuit: Explain why adding a second branch to a circuit *decreases* the total resistance, even though you are adding another component.

- Application: Identify which type of circuit (series or parallel) is used for household lighting so that one bulb failing does not turn off all the lights in the house. Justify your answer using the concept of independent branches.