SUBJECT: Physics YEAR: 10 MTP TITLE: Particle Model HALF TERM: 1 NO. OF LESSONS (approx): 7

Deliberate and specific retrieval of expected prior knowledge

- States of matter: At KS3, students learn that matter exists in three primary states: solid, liquid, and gas. They should be familiar with the basic properties of each state (e.g., solids have a fixed shape, liquids have a fixed volume but not shape, and gases have neither fixed shape nor volume)
- Particle theory: Basic understanding that matter is made up of particles (atoms and molecules) and that the arrangement and movement of these particles differ between solids, liquids, and gases.
- Changes in state: Students should understand that substances can change state through processes like melting, freezing, condensation, and evaporation, and these changes involve energy.
- Density: KS3 students should know that density is a property of materials and can be calculated using the formula Density=mass/volume
- .Heat and temperature: Basic understanding that heat is a form of energy and that temperature measures the average kinetic energy of particles.

Academic transformation

Students will understand:

- Particle Model of Matter: Students will deepen their understanding of how the behavior of particles explains the properties of solids, liquids, and gases. They will learn about the arrangement, motion, and energy of particles in different states.
- Internal Energy: Students will learn that the internal energy of a substance is the total energy of all the particles, combining both kinetic and potential energy.
- Motion of particles in gases: Students will learn the relationships between pressure, volume, and temperature in gases.
- Pressure in gases: Students will learn that compression or expansion can change gas pressure. They will use the following equation for a fixed gas held a constant temperature: pressure x volume = constant (PHY ONLY)
- Increasing pressure of a gas: Doing work on a gas increases the internal energy of the gas and can cause an increase in temperature. Example could be given of a bike pump (PHY ONLY)
- Density in Practice: Students will investigate how to calculate the density of regular and irregular shaped objects.

Personal transformation

Real-life connections:

- Why balloons deflate: Understanding how temperature affects gas molecules in a balloon, leading to the deflation when it gets colder.
- Weather phenomena: How evaporation and condensation work in weather systems, explaining processes like cloud formation and rainfall.
- Thermal insulation: The science behind materials used in insulation for homes, how different materials slow down heat transfer, and their particle behavior.

Technological applications:

- Cryogenics and supercooled liquids: The exploration of how understanding the particle model enables the creation of extreme temperatures in applications like liquid nitrogen or superconductors.

Can I Learning Questions

- Can I recall the particle model and explain energy transfers?
- Can I gather data to calculate density?
- Can I describe changes in state?
- Can I describe particle motion within a gas?
- Can I describe internal energy changes in a system?

Literacy and Oracy

Website links and resources:
PhET Interactive Simulations: Matter Simulations by PhET - Use these to visualize how particles behave in different states of matter.
BBC Bitesize: Particle Model of Matter - BBC – A helpful resource for revision and concept reinforcement.
Tasks for reports:
Energy and State Changes: Have students write a report on the energy changes during a phase change (e.g., melting, boiling) and how the particle model explains these changes.
Density Experiment: Write a report on an experiment investigating how to calculate the density of irregular and regular shaped objects.
Verbal Discussion:
Class discussion on temperature vs. heat: Lead a debate or discussion on the difference between heat and temperature. Use everyday examples to illustrate.
Gas Behavior Discussion: Students can explain how the gas laws (Boyle's and Charles's) work in real life, such as in a bicycle pump or a balloon. (PHY ONLY)
Tier 2 vocabulary
Motion, energy, internal, model, temperature
Tier 3 vocabulary
Kinetic, potential, density, pressure, matter, state, volume

Misconceptions

Misconception: Particles in a solid are stationary:
Correction: Particles in a solid vibrate but remain in fixed positions, and this is why solids maintain their shape.
Misconception: Temperature is the same as heat:
Correction: Temperature is a measure of the average kinetic energy of particles, while heat is the energy transferred from one object to another due to temperature difference.
Misconception: Gases have no mass:
Correction: Gases do have mass, which is why they can exert pressure and can be weighed.
Misconception: Particles are the same in all states of matter:
Correction: The arrangement and movement of particles vary significantly between solids, liquids, and gases, which explains the differences in properties (e.g., density, flow).