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| **Particles (~20 lessons)** – In this unit, you will build on your knowledge of materials from primary school to learn about what everything in our universe is made up of, why ice creams melt on a hot day and why balloons pop when left out in the sun! You will develop your practical skills to understand how to conduct fair, reliable investigations and how to carry out experiments safely in a science lab. | | | | |
| **Core Questions for the Unit** | 1. **Lab safety- hazards, risks, chemical symbols and safely using Bunsen Burners.** 2. **What are the similarities and differences between solids, liquids and gases?** 3. Identifying solids, liquids and gases from particle diagrams 4. State the 3 states in terms of the particle model (diagrams) 5. Describe the particle arrangement in solids, liquids and gases (explaining this in terms of energy) 6. Describe the properties of solids, liquids and gases 7. Link property to the particle model of the 3 states 8. **What are the three changes of state? Describe them in terms of energy. How to they occur?** 9. Describe the changes of state 10. Explain melting and freezing using the particle model 11. Explain boiling using the particle model 12. Describe the differences between boiling and evaporation. 13. Explain condensing using the particle model 14. Describe sublimation using the particle model and link to energy (higher) 15. **What is diffusion?** 16. State examples of diffusion (in terms of chemistry) 17. Describe what particles do in diffusion 18. **What are the factors that affect diffusion?** 19. Explain why temperature/ concentration (surface area) affects diffusion (other factors can be covered in biology)   b) Required practical   1. **How does Brownian motion occur in gases?** 2. State how Brownian motion is observed 3. Describe how particles in a gas/ liquid cause Brownian motion 4. Apply Brownian motion to different scenarios 5. **How do particles cause gas pressure?** 6. Use the particle model to explain gas pressure 7. Factors which affect gas pressure | | | |
| **Scientific skills** | Using lab equipment safely  Understanding and identifying scientific variables  Using models to illustrate scientific theories  Recording observations  Forming conclusions based on observations  Analysing data  Presenting data using tables and graphs | | | |
| **Links to other subjects** | Biology – Diffusion  Physics – Particle model and gas pressure  Maths – Numeracy and graph analysis | | | |
| **Development of new knowledge** | **(1)** Lab safety  **(2a-c)** Similarities and differences, including density differences, between solids, liquids and gases  **(2d-e)** The properties of the different states of matter (solid, liquid and gas) in terms of the particle model  **(7a-b)** Explaining gas pressure  (**3a-f)** Changes of state in terms of the particle model  **(3b)** conservation of material and of mass, and reversibility, in melting, freezing  **(3c-e)** conservation of material and of mass, and reversibility evaporation, , condensation  **(3f)** conservation of material and of mass, and reversibility sublimation  **(6a-c)** Brownian motion in gases  **(4a-b)** Diffusion in terms of the particle model  **(5a-b)** Diffusion in liquids and gases driven by differences in concentration  **(5b)** Investigating diffusion | | **Strengthening of prior**  **Knowledge** | **SCIENCE**  Working Scientifically Skills:  **Aware of dangers**  **Observed evaporation**  Scientific content:  **Year 6:**  **(2d)** Is able to describe solids, liquids and gases based on their molecular structures.  **(3a)** Is beginning to understand the difference between reversible and irreversible change.  **Year 4:**  **(2a-b)** Has the ability to group materials into solids, liquids and gases and compare their properties.  **(3a-f)** Is able to describe physical changes when materials are heated or cooled and can state the temperature that these changes occur (e.g. freezing and boiling points of water). |
| **Vocabulary:**  These are the main words we will be using | **Tier 2 Words:**    Observation  Prediction  Table  Record  Analyse  Changes  Compare  Contrast  Changes  Patterns  Similarities  Conclusion  Formula  Function  Process  Boiling  Rate | **Tier 3 Words:**  Kinetic  Diffusion  Sublimation  Evaporation  Conservation  Melting point  Boiling point  Condensation  Brownian  Particles  Concentration  Surface area  Bonds | **Reading Opportunities**  **Numeracy Opportunities** | * Article about shark’s finding prey – can use as a way to explain diffusion/ apply to a new scenario   <https://www.ripleys.com/weird-news/sharks-smell-blood/>   * Article on states and comprehension questions (online activity) - [http://www.softschools.com/language\_arts/reading\_comprehension /science/49/solids\_liquids\_and\_gases/](http://www.softschools.com/language_arts/reading_comprehension%20/science/49/solids_liquids_and_gases/) * Reading temperature * Measuring * Surface area calculations/ awareness * Graph plotting * Calculating a mean * Using different units |
| **The activities you are likely to do in lesson.** | **1. Lab safety- hazards, risks, chemical symbols and safely using Bunsen Burners**  1) Retrieval Practice – quick quiz on lab equipment  1. Hazard symbols hunt. Students should know the hazard symbols for different hazards.  1. Spot the hazards image. Students would be able to identify and write down hazards present in an image.  1. ILT competition for lab safety poster  1) Reading Opportunity – Spot the mistakes in the method  1. Bunsen burner licence. Student must complete the Bunsen burner assessment (practical) safely to pass to be able to use them independently during practicals.  **2. What are the similarities and differences between solids, liquids and gases?**  2) Retrieval – 5 questions  2a) Give students a variety of substances that are solids liquids and gases within closed syringes. Get students to categorise substances based on their appearance/ behaviour. Challenge- include gels/ foams  2a) Assessment of prior knowledge- image annotated to show current understanding of the topic.  2b) Modelling state of matter (plastecine). Students can demonstrate the arrangement of particle sin solids, liquids and gases. Students can then draw and label diagrams in books.  2a) Reading opportunity and comprehension- solids, liquids and gases online information and questions  2c) Acting out states of matter as a class with students representing the particles to demonstrate energy and particle arrangement.  2c) Simulations (eg computer programmes such as echalk)  2c) Compare energy levels of different states comparing to students energy levels (red bull analogy). Written task to describe (higher level explain).  2d) Students draw and complete a Venn diagram to compare properties of solids, liquids and gases.  2d) Debate task- Use particle theory to debate if substances such as gels/foams are solids, liquids or gases.  **3. Changes of state in terms of the particle model. Melting and freezing.**  3) Retrieval – Do it now  3a) Demonstration- ice/water/steam. Measure the mass of the ice and water to demonstrate conservation of mass. Students discuss what they observe about the mass change.  3) Decode- Tier 2 words  3) decode – strength of tier two words  3a) Modelling use fists/ pupils to demonstrate how energy levels and movement changes during changes of state.  3a) Analogy of red bull and a student compared to a particle and heat energy.  3a) Stearic acid practical- observing melting points. Students write predictions, carry out investigations, record in tables, plot graphs, and write conclusions.  3a) Over all diagram/flow diagram developed over the lessons to clearly show all changes of state. Students organise information in a clear in concise way (frame work given to students and can be labelled throughout the changes of state lessons).  3) Knowledge Audit Test  **3b) Boiling**  2) Retrieval – 5 questions  3b) Link to real world applications to engage relevance (eg making a cup of tea)  3b) Demonstration of boiling. Students make observations/ answer questions based on their observations. They should be able to record observations about bubbles.  3b) Particle model showing boiling- use of plastercine to model what happens within the bubbles during boiling. Students should be able to label the differences in particle spaces, gases/ liquids.  3b) Data analysis task- Boiling points of a range of substances where students identify substances/ boiling points/ states of matter  3) Decode – sentence structure  3b) Analysis of graphic data. Include mistakes for the students to spot and correct to support with graph plotting skills?  **3c) Evaporation and condensation**  2) Retrieval – 5 questions  3c) Literacy task (eg beat the teacher) to write a definition of evaporation  3c) Competition to engage students- ‘Who can make the biggest crystals?’. Students can make conclusions about what temperature produces the largest copper sulphate crystals.  3c) Writing opportunity- Write a letter to a staff member the students know about how to survive in the desert. Students should discuss how evaporation and condensation occurs, how changes of state occur, changes in energy etc. You can scaffold/ increased in challenge based on the students you are delivering to.  **3d) Sublimation**  2) Retrieval – 5 questions  3d) Order and show student dry ice (if not able to order a video can be used to demonstrate sublimation). Students record their observations and compare this to their changes of state diagram.  **4a) Diffusion in terms of the particle model/ Diffusion in liquids and gases driven by differences in concentration.**  2) Retrieval – 5 questions  4b) Demonstration using air freshener and timers/ student put their hand up when they smell the spray  4b) Real life examples and applications of diffusion (burnt toast, farts, perfume etc)  4b) Reading opportunity- Sharks and diffusion  4a) Write a definition of diffusion using key terms.  **5) Factors which affect diffusion.**  2) Retrieval – 5 questions  5a) Students should be able to write a description (more able explain) of what factors affect the rate of diffusion.  5a) Temperature- students can investigate how temperature of water affects the rate of the diffusion of potassium permanganate. Students record results and write a conclusion.  5b) Reading opportunity- ‘Pool prankster’ newspaper article. Provides students with the scenario, Students will need to highlight key terms and points and summarise the information questions answered based on ability of group)  5b) Writing opportunity- Planning task. Writing methods, risk assessments, predictions  5b) Required practical- scientific inquiry. Use of dyed agar to investigate the effect of temperature on diffusion (SA for higher ability).  5b) Practical write up- record data in a table, plot data on a graph, writing- conclusion (describing and explaining results). Evaluation of practical method and results. How could they improve this? How could they investigate another variable?  **6.Brownian motion in gases**  6)Modelling using marbles and balls  6)Written description of Brownian motion using key terms  6) Reading opportunity –Article on Brownian Motion  6) Retrieval Practice- Loop game could be an option?  **7.Gas Pressure**  7) Retrieval Practice – Do it now for whole topic  7a) Demonstrate gas pressure linked to real life application- Guinness world records video of a man inflating a hot water bottle, hot air balloons.  7a) Practical- inflating balloons- questions how the balloon is inflating.  7b) Data analysis- graph plotting drawing conclusion using data about gas pressure and temperature/ pressure | | | |
| **How you will be assessed.** | You will be assessed by:   * A retrieval quiz during the Do It Now of every lesson. * Mini quizzes and challenges during lesson. * A progress assessment in the middle of the unit – Here we will reflect and improve on key areas and complete DIRT work.   An end of unit assessment that assesses your knowledge and skills that you have built in this unit and previous units that we link back to. | | | |