Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Week 1 Lesson 1 How can energy be stored and transferred? What is the conservation of energy?	Closed system, Energy store work done, Conservation of energy, Dissipated.	Energy in action	Recall the law of conservation of energy. Identify situations in which energy is stored Recall the units of energy	1. Explain that where there are energy transfers in a closed system there is no net change to the total energy in that system 2. Analyse the changes involved in the way energy is stored when a system changes 3. Draw and interpret diagrams to represent energy transfers 4. Explain how in all system changes energy is dissipated so that it is stored in less useful ways	Draw a roller coaster at four points: top of hill, bottom, top of loop, and end. Label energy stores (e.g., kinetic, potential, thermal). Explain how energy is transferred and why total energy stays the same in a closed system. Describe how some energy is dissipated (e.g., friction, sound) and why it's less useful. Suggest how engineers could reduce energy loss. Extension: pick another system (e.g., pendulum) and sketch its energy changes.
Week 1 Lesson 2 How do we calculate how efficient energy transfers are?	Efficiency, useful	Energy in action	What does it mean if an energy transfer is efficient? What is the formula for efficiency? What unit is energy measured in?	**1. (HT) Explain how efficiency can be increased** 2. Recall and use the equation for efficiency . 3. Explain that mechanical processes become wasteful when they cause a rise in temperature. 4. Explain ways of reducing unwanted energy transfer. 5. Draw and interpret energy transfer diagrams. (Sankey diagrams)	A toaster takes in 2000 J of electrical energy and transfers 800 J to the bread as thermal energy. 1) Calculate efficiency of the toaster 2) Draw a Sankey diagram to represent this 3)Suggest ways of improving the efficiency
Week 2 Lesson 1 How do we control energy transfers –	Conduction, insulation, vibrating,	Energy in action	What is a conductor? What is an insulator?	1. Explain ways of reducing unwanted energy transfer. 2. Describe the effects of the thickness and thermal	Define Unwanted Energy Transfer In your own words, explain what unwanted energy transfer is and why it's important to reduce it in homes and buildings.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
using conductors and insulators?	particles, thermal		Give an example of a good thermal conductor. Why do we use insulators in buildings?	conductivity of the walls of a building on its rate of cooling qualitatively	Describe the roles of conductors and insulators in energy transfer. Give two real-life examples of each (e.g., metal spoon, wool jumper). Explain how the thickness and material of walls affect the rate of heat loss in buildings. Why do some materials slow down heat transfer better than others? Define thermal conductivity and explain how it influences the rate of cooling in a building. Which types of materials have low thermal conductivity?
Week 2 Lesson 2 How can we calculate how much energy is stored in an object that is off the ground?	mass. gravity, velocity	Energy in action	KE, GPE unit of energy	1. Recall and use the equation to calculate the change in GPE when an object is raised above the ground: $\Delta GPE = m \times g \times \Delta h$	Practise the gravitational potential energy equation questions.
Week 2 Lesson 3 (Groups 4,5,6 only) **Responsive Curriculum** Key concepts in biology - Enzymes	Enzyme Active site Denature Substrate	Biological Molecules and Processes	Enzymes	Define enzymes and explain their role in biological processes. Understand the structure and function of enzymes. Explain enzyme action. Understand factors that affect enzyme activity.	Complete appropriate exam questions

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Week 2 Lesson 4 How can we calculate how much energy is stored in an object that is moving?	mass. gravity, velocity	Energy in action	What is kinetic energy? What two factors affect the amount of kinetic energy an object has? What is the unit of energy?	2. Recall and use the equation to calculate the amounts of energy associated with a moving object: KE = ½ × m × v2	Practise the kinetic energy equation questions.
Week 2 Lesson 5 How can we calculate how much energy is stored in an object that is off the ground or moving?	mass. gravity, velocity	Energy in action	KE, GPE unit of energy	1. Recall and use the equation to calculate the change in GPE when an object is raised above the ground: ΔGPE = m × g × Δh 2. Recall and use the equation to calculate the amounts of energy associated with a moving object: KE = ½ × m × v2	1)Write down the equations for: GPE and KE 2) A 2 kg object is lifted to a height of 5m Calculate the GPE. 3)A 2 kg object is moving at 6 m/s. Calculate the KE. 4)Compare the GPE and KE values. What happens to the energy if the object falls from the height? How do changes in height or speed affect the energy stored?
Week 3 Lesson 1 What are non-renewable energy resources, how do they work?	non-renewable, Fossil fuels	Energy in action	Name three non-renewable energy resources. What is the main disadvantage of using fossil fuels?	1. Describe the main non-renewable energy sources available for use on Earth 2. Compare the ways in which both renewable and non-renewable sources are used 3. Explain patterns and trends in the use of energy resources	Write down the three main non-renewable energy sources used on Earth. For each, describe how it is used and one environmental impact it causes. Choose two renewable energy sources (e.g., solar, wind, hydro). Compare them with non-renewables in terms of: Availability, Environmental impact, Long-term sustainability Describe two global trends in energy use (e.g., decline in

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
			What is combustion?		coal, rise in solar). What are the main reasons for these changes? Think about cost, climate, and technology.
Week 3 Lesson 2 What are renewable energy resources, how do they work?	Renewable, solar, environment unreliable	Energy in action	Name three renewable energy resources. Which renewable energy resource uses sunlight to generate electricity?	1. Describe the main renewable energy sources available for use on Earth 2. Compare the ways in which both renewable and non-renewable sources are used 3. Explain patterns and trends in the use of energy resources	Write down the five main renewable energy sources: solar, wind, hydro, geothermal, and biomass. For each, describe how it works and give one real-life example of its use. Choose two renewable and two non-renewable energy sources. Compare how they are used in everyday life (e.g., home heating, transport) and industry (e.g., electricity generation, manufacturing). Describe two current trends in global energy use (e.g., growth in solar power, decline in coal). Explain why some renewable sources are becoming more popular. List two benefits of increasing renewable energy use. Then describe two challenges.
Week 3 Lesson 3 (Groups 1,2.3 only) **Responsive Curriculum** Key concepts in biology - Enzymes	Enzyme Active site Denature Substrate	Biological Molecules and Processes	Enzymes	Define enzymes and explain their role in biological processes. Understand the structure and function of enzymes. Explain enzyme action. Understand factors that affect enzyme activity.	Complete appropriate exam questions
Week 3 Lesson 4 How can energy change a system?	Energy system work done force	Energy in action	What is meant by a “system” in physics? Give an example of a system where energy is	Identify the different ways that the energy of a system can be changed a) through work done by forces b) in electrical equipment c) in heating.	Write a short explanation of how energy in a system can be changed by work done by forces. Include one example (e.g., lifting a box, stretching a spring) and describe the energy transfer involved. Choose one piece of electrical equipment (e.g., kettle,

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

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			transferred. What happens to the energy in a system when work is done? What is thermal energy?		phone charger, electric motor). Explain how it transfers or transforms energy within a system (e.g., electrical to thermal, kinetic, or light). Describe how heating causes energy changes in a system. Include an example (e.g., heating water, warming a room) and explain what energy stores are involved.
Week 3 Lesson 5 What is work done and how can it be measured and calculated?	Newton meter	mechanics	What is the definition of "work done" in physics? What is the formula for calculating work done? What are the units of force, distance, and work done?	1. Describe how to measure the work done by a force 2. Describe energy transferred (joule, J) is equal to work done (joule, J) 3. Recall and use the equation: $E = F \times d$ 4. Describe and calculate the changes in energy involved when a system is changed by work done by forces.	In your own words, describe how to measure the work done by a force. Why is it important to measure both the force applied and the distance moved? Use the equation for work done to solve the following: A person pushes a box with a force of 50 N over a distance of 3 m. How much work is done? A crane lifts a 200 N load 5 m vertically. How much energy is transferred? Explain Energy Changes (3 minutes) Choose one of the examples above. Describe how the energy of the system changes as a result of the work done. What energy store increases or decreases?
Week 4 Lesson 1	power	Energy in action	What does "power" mean in physics?	1. Define power as the rate at which energy is transferred and use examples to explain this	Write a definition of power, give two real-life examples. Write down the equation for power, solve the following: A motor transfers 6000 J of energy in 30 seconds.

Science Autumn Half Term 1 Year 10

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What is power and how is it calculated?			What is the formula for calculating power? What is the unit of power?	definition. 2. Recall and use the equation: P = E/T 3. Recall that one watt is equal to one joule per second, J/s 4. Explain ways of reducing unwanted energy transfer through lubrication	What is its power output? A 100 W light bulb is on for 10 seconds. How much energy does it transfer? Lubrication and Energy Loss (3 minutes) Explain how lubrication (e.g., oil in an engine) reduces unwanted energy transfer due to friction. Why is this important in mechanical systems?
Week 4 Lesson 2 **Investigative Skills: What factors affect solar cells (L1)**	voltage solar cell light intensity distance	Thinking Like a Scientist Experimental and Investigative Skills Analysis and Evaluation SI units and Calculating	Variables Fair test Evaluations Graphs Energy stores	1. To plan an investigation into the factors affecting the output from a solar panel. 2. Draw a results table 3. Record results.	Evaluate data and practical.
Week 4 Lesson 3 (Groups 4,5,6 only) **Responsive Curriculum** States and mixtures	Distillation Chromatography Crystallisation Filtration	Particles and Matter	Mixtures, particles	1. Describe which method to use for a variety of mixtures. 2. Explain how each method separates mixtures.	Complete exam questions
Week 4 Lesson 4	voltage solar cell light intensity distance		Variables Fair test Evaluations Graphs	4. Draw a graph. 5. Evaluate data and practical.	Evaluate data and practical.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Investigative Skills: What factors affect solar cells (L2)			Energy stores		
Week 4 Lesson 5 How can objects affect each other at a distance or when touching?	lubrication	Energy in action	fields energy stores	1. Describe, with examples, how objects can interact a) at a distance without contact, linking these to the gravitational, electrostatic and magnetic fields involved b) by contact, including normal contact force and friction c) producing pairs of forces which can be represented as vectors 2. Explain the difference between vector and scalar quantities using examples 3. Explain ways of reducing unwanted energy transfer through lubrication	Describe how objects can affect each other: At a distance: through gravitational, electrostatic, and magnetic fields By contact: through normal contact force and friction Give one real-life example for each type of interaction. Force Pairs and Vectors - Explain how these interactions always involve pairs of forces (Newton's Third Law). Draw a simple diagram showing a force pair (e.g., a book on a table, or magnets attracting). Use arrows to represent the magnitude and direction of each force (vectors). Vector vs. Scalar Quantities - Define and explain the difference between vector and scalar quantities. Give two examples of each. Reducing Friction - Describe how lubrication (e.g., oil or grease) reduces unwanted energy transfer caused by friction in contact forces. Why is this useful in machines?
Week 5 Lesson 1 **How do we make and resolve forces**	resultant force free body diagram	Mechanics	What is a force diagram? What does the length of an	**1. Use vector diagrams to illustrate resolution of forces, a net force, and equilibrium situations.**	Choose two objects from the list below and draw a free body diagram for each, showing all the forces acting on them: A book resting on a table, A skydiver falling at terminal velocity, A car accelerating forward, A hanging

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
in a free body diagram? (HT)			arrow show in a force diagram? What is meant by a balanced force?	**2. Draw and use free body force diagrams** **3. Explain examples of the forces acting on an isolated solid object**	object on a rope, Label each force clearly (e.g., weight, normal force, tension, friction). Write a short explanation of: One example where several forces combine to produce a resultant force (e.g., a cyclist pedalling uphill) One example where balanced forces result in no change in motion (e.g., a stationary object)
Week 5 Lesson 2 What are ions?	Ion Electron Positive ion (cation) Negative ion (anion) Charge Atom	Bonding and properties	What is the difference between an atom and an ion? draw and label an atom	1.Explain how ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams. 2.Recall that an ion is an atom or group of atoms with a positive or negative charge. 3.Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number 4.Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7. 5.Recall the formulae of elements, simple compounds and ions	Draw a dot and cross diagram to show how sodium (Na) and chlorine (Cl) form an ionic bond. Show the transfer of one electron from sodium to chlorine. Label the resulting Na^+ and Cl^- ions. What is an Ion? (2 minutes) In your own words, define what an ion is. Explain the difference between a cation and an anion, and how they form. Use the atomic number and mass number to calculate the number of protons, neutrons, and electrons in the following ions: Mg^{2+} (Magnesium ion) O^{2-} (Oxide ion) Explain how elements in Groups 1, 2, 6, and 7 form ions. Include examples like Na^+, Ca^{2+}, O^{2-}, and Cl^-. Why do these elements gain or lose electrons?
Week 5 Lesson 3 (Groups 1,2,3 only)	Distillation Chromatography	Particles and Matter	Mixtures, particles	3. Describe which method to use for a variety of mixtures.	Complete exam questions

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Responsive Curriculum States and mixtures	Crystallisation Filtration			4. Explain how each method separates mixtures.	
Week 5 Lesson 4 How do ions join to make a new substance?	Ionic bond Electrostatic attraction Metal Non-metal Compound Formula Giant ionic lattice	Bonding and properties	What type of elements usually form positive ions? and What type of elements usually form negative ions?	1.Explain the use of the endings –ide and –ate in the names of compounds. 2.Recall the formulae of elements, simple compounds and ions. 3.Deduce the formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions. 4.Explain the structure of an ionic compound as a lattice structure a) consisting of a regular arrangement of ions b) held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions.	Explain the difference between the endings –ide and –ate in ionic compound names. What does –ide indicate? What does –ate indicate? Give one example of each (e.g., sodium chloride, sodium sulfate). Write the correct chemical formulae for the following: Sodium Chloride ion Nitrate ion Calcium carbonate Magnesium hydroxide (Hint: Use ion charges to balance the formulae) Using the charges of the ions, deduce the formulae for: Aluminium oxide Potassium sulfate Calcium nitrate Iron(III) chloride Show how the charges balance in each case.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

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Week 5 Lesson 5 What are the properties of ionic substances?	High melting point Soluble Conductivity Solid Aqueous Brittle Lattice structure	Bonding and properties	Are ionic compounds usually solid or liquid at room temperature? Why? and draw the particle arrangement of solid liquid and gas	Explain the properties of ionic compounds limited to: a) high melting points and boiling points, in terms of forces between ions b) whether or not they conduct electricity as solids, when molten and in aqueous solution.	Explain why ionic compounds have high melting and boiling points. Describe the role of strong electrostatic forces between oppositely charged ions. Explain why a lot of energy is needed to overcome these forces during a change of state. Describe the electrical conductivity of ionic compounds in different states: Why do they not conduct electricity as solids? Why do they conduct when molten or dissolved in water? Use particle movement to support your explanation. List two examples of ionic compounds (e.g., sodium chloride, calcium carbonate). For each, describe one property and explain how it relates to its real-world use (e.g., table salt, antacid, road grit).
Week 6 Lesson 1 Ionic Bonding Practise	Ionic bond Electrostatic attraction Metal Non-metal Compound Formula Giant ionic lattice	Bonding and properties	Atoms, ions, ionic bonding	Consolidate knowledge of ionic bonding	Practise exam questions on ionic bonding.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Week 6 Lesson 2 How do non-metals bond?	Covalent bond Shared electrons Molecule Non-metal Simple molecular structure Bond pair	Bonding and properties	What is a molecule? What happens to electrons in a covalent bond?	1. Explain how a covalent bond is formed when a pair of electrons is shared between two atoms. 2. Recall that covalent bonding results in the formation of molecules. 3. Recall the typical size (order of magnitude) of atoms and small molecules. 4. Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: a) hydrogen, b) hydrogen chloride, c) water, d) methane, e) oxygen, f) carbon dioxide	In your own words, explain how a covalent bond forms. What happens to the electrons? Why does this make atoms more stable? Draw dot and cross diagrams to show covalent bonding in the following molecules: Hydrogen (H_2) Water (H_2O) Methane (CH_4) Oxygen (O_2) Carbon dioxide (CO_2) Use different symbols (dots and crosses) for electrons from different atoms.
Week 6 Lesson 3 (Groups 4,5,6 only) **Responsive Curriculum** Forces and motion – Acceleration	Velocity Scalar Vector Time Gradient Calculate	**SI units and Calculating**	Velocity Scalar/vectors	Calculate the distance travelled on a velocity-time graph. Calculate acceleration Calculate the acceleration from a velocity-time graph (gradient)	Complete appropriate exam questions
Week 6 Lesson 4	Low melting point Insulator Weak	Bonding and properties	Are covalent substances usually gases, liquids, or solids	1.Explain the properties of typical covalent, simple molecular compounds limited to a) low melting points and boiling	Explain why simple molecular covalent compounds (e.g., water, carbon dioxide) have low melting and boiling points.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
What are the properties of covalent structures?	intermolecular forces Simple molecular Giant covalent Insoluble		at room temperature? Do covalent substances conduct electricity? Why or why not?	points, in terms of forces between molecules (intermolecular forces) b) poor conduction of electricity 2.Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms	Focus on the weak intermolecular forces between molecules. Compare this to the strong ionic or metallic bonds in other substances. Why do simple molecular substances not conduct electricity? Mention the absence of free-moving charged particles (like ions or electrons). Describe what a polymer is and explain how poly(ethene) is formed. Include the idea of long chains of carbon atoms. How does the size of polymer molecules compare to simple molecules?
Week 6 Lesson 5 How many ways can carbon bond?	Carbon Diamond Graphite Fullerenes Nanotubes Allotropes	Bonding and properties	What is the name of the carbon structure used in pencils? What is a fullerene?	1.Recall that graphite and diamond are different forms of carbon and that they are examples of covalent giant molecular substances. 2.Describe the structures of graphite and diamond. 3.Explain, in terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools. 4.Explain the properties of	Write a short description of the structures of: Diamond – include how many atoms each carbon is bonded to and the shape of the structure. Graphite – describe the layers of hexagonal rings and the forces between them. Why is diamond used in cutting tools? Why is graphite used in lubricants and electrodes? Link your answers to their structure and bonding. What is a fullerene (e.g., C_{60})? Describe its shape and bonding.

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
				fullerenes (e.g. C60) and graphene in terms of their structures and bonding.	What is graphene and why is it considered a special material? Mention at least one use for each.
Week 7 Lesson 1	PAZ: Biology assessment				
Week 7 Lesson 2	PAZ: Chemistry assessment				
Week 7 Lesson 3 (Groups 1,2,3 only) **Responsive Curriculum** Forces and motion - Acceleration	Velocity Scalar Vector Time Gradient Calculate	**SI units and Calculating**	Velocity Scalar/vectors	Calculate the distance travelled on a velocity-time graph. Calculate acceleration Calculate the acceleration from a velocity-time graph (gradient)	Complete appropriate exam questions
Week 7 Lesson 4	PAZ: Physics assessment				
Week 7 Lesson 5 Covalent bonding practise	Low melting point Insulator Weak intermolecular forces Giant covalent Insoluble	Bonding and properties	Atoms, ions, covalent bonding, allotropes of carbon	Consolidate knowledge of covalent bonding	Practise exam questions on covalent bonding.
Week 8 Lesson 1 How do metals bond?	Metallic bond Delocalised electrons Positive ions Lattice Conductivity Malleable	Bonding and properties	What happens to electrons in metallic bonding? What is meant by a "sea of delocalised	1. Describe how metal ions are bonded within a metal. 2. Recall which ions are formed in different metals. 3. Compare the structure and movement of ions in pure metals and alloys.	Describe how metal atoms form positive ions and how they are held together in a metal. What is meant by a 'sea' of delocalised electrons? Why is this important for bonding? Recall the ions formed by these metals and write their symbols: Iron, Copper, Sodium, (e.g., Fe^{2+}, Cu^{2+}, Na^{+}) Structure of Metals vs Alloys (4 minutes)

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
			electrons"? Why are metals good conductors of electricity?		Compare the structure of pure metals and alloys: Draw a simple diagram of each (label the regular vs irregular arrangement of atoms). Explain how this affects malleability and strength. Explain why metals conduct electricity. What role do delocalised electrons play? Why is this useful in real-world applications? In 2–3 sentences, explain why alloys are often harder than pure metals. Give one example of a common alloy and its use (e.g., steel, bronze).
Week 8 Lesson 2 What are the properties of metals and alloys?	Alloy Malleable Ductile Conductor Strong Layers	Bonding and properties	What is an alloy? Why are alloys usually stronger than pure metals? Name two properties of metals.	1. Explain the properties of metals, including malleability and the ability to conduct electricity. 2. Describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors.	Write a short paragraph explaining the typical properties of metals. Include the following terms: Malleable High melting point High density Electrical conductivity Shiny appearance Write a paragraph comparing non-metals to metals. Mention their boiling points, electrical conductivity, and physical state at room temperature. Give two examples of non-metals and their uses.
Week 8 Lesson 3 (Groups 4,5,6 only)	Mitosis Interphase Prophase Metaphase	**Cells and Systems**	Cells, growth, stem cells	• Describe the stages of mitosis • Describe and explain the uses of stem cells	Complete appropriate exam questions

Holy Family Catholic School – Faculty of Science & Physiology

Science Autumn Half Term 1 Year 10

Learning Intention	Vocab	Concept	Retrieval	Success Criteria	Red Zone
Responsive Curriculum Cells and control	Anaphase Telophase Cytokinesis Neurone			• Describe a neurone • Describe the reflex arc	
Week 8 Lesson 4	Ionic Covalent Metallic Structure Properties Conductivity Melting point	Bonding and properties	Which type of bonding involves the transfer of electrons? Which type of bonding involves shared electrons? Which type of bonding allows substances to conduct electricity when solid?	1. Explain why elements and compounds can be classified as: ionic, simple molecular, giant covalent and metallic. 2. Explain how the structure and bonding of these types of substances results in different physical properties. 3. Describe the limitations of particular representations and models to include dot and cross, ball and stick models and two- and three-dimensional representations	Classify each of the following substances as ionic, simple molecular, giant covalent, or metallic: Sodium chloride, Water, Diamond, Copper For each substance, explain how its structure and bonding affect its: Melting point, Hardness, Electrical conductivity, Use 1–2 sentences per substance. Choose one type of bonding (e.g., covalent, ionic, or metallic). Describe the strengths and limitations of using the following models to represent it: Dot and cross diagrams Ball and stick models 3D representations Use examples to support your explanation (e.g., water for covalent, NaCl for ionic).
Week 8 Lesson 5 Bonding practise	Ionic, Covalent, Metallic, model	Bonding and properties	Atoms, ions, bonding types	Consolidate knowledge of bonding and properties of substances	Practise exam questions on bonding and substances.