

WCSA



Home Learning Book – Learning Cycle 2

Year 10

Design & Technology

Resistant Materials Focus

Completion dates;

Week 1

Week 5

Week 2

Week 6

Week 3

Week 7

Name: _____ Tutor Group: ____

Teacher(s): _____

Why is regular home learning important?

- It can improve a student's thinking and memory skills. This is vital for the new GCSEs.
- It helps students to develop positive study skills and habits that will serve them well throughout life.
- Home learning encourages students to use time wisely and efficiently.
- It teaches students to work independently.
- Home learning teaches students to take responsibility for their own work.
- It allows students to review and practice what has been covered in class and consolidate their knowledge and skills.
- Equally important, it helps students to get ready for the next day's class.
- It helps students learn to use resources, such as libraries, reference materials, and computer Web sites to find information.
- It encourages students to explore subjects more fully than classroom time permits.
- It allows students to extend their learning by applying skills to new situations.
- Home learning helps parents learn more about what their children learning in school.
- It allows parents to communicate with teachers about learning in order to support their children efficiently.

Week 1: Energy generation

1. Which of the following statements about fossil fuels is **false**? [1]

- ◇ Fossil fuels are burned to create heat, which fires steam-driven turbines
- ◇ Fossil fuels include gas, oil and coal
- ◇ Fossil fuels produce no CO₂ when burned
- ◇ Fossil fuels cannot be replaced as fast as they are being used

2. Name **three** different renewable energy sources. [3]

3. The National Grid is the network of power cables that connect power sources to supply electricity to businesses and homes in the UK.

Discuss how the National Grid ensures a consistent supply of power on a cold and still winter's evening and justify why demand might be high at this point? [5]

4. Explain how fossil fuels are used to produce electricity. [3]

5. Explain how shale gas is produced by fracking (hydraulic fracturing). [3]

Week 2: Energy storage

1. Which **one** of the following is a type of kinetic energy? [1]

- ◇ Mechanical
- ◇ Sound
- ◇ Chemical
- ◇ Nuclear

2. Name **three** simple methods of storing energy that can be found in most homes or in a design and technology workshop? [3]

3. Explain the difference between **potential** and **kinetic** energy, giving **one** example for each. [4]

4. Describe how flywheels can be used to store surplus energy and smooth erratic energy generation from some renewable sources. [6]

5. Describe the use of energy storage systems, including kinetic pumped storage systems, to use surplus energy to help smooth peak supply and balance the demand on the National Grid. [4]

You may use a diagram to aid your answer.

6. Standard alkaline battery cells are 1.5V.

(a) State the voltage of a rechargeable cell.

[1]

(b) How many rechargeable cells would be required in a 12V battery?

[1]

Week 3: Keywords

Research and explain the definitions of the following key words giving examples where appropriate:

<i>Key Word</i>	<i>Definition</i>
Titanium	
Graphene	
LCDs	
Smart materials	
Thermochromic	
Shape memory alloys	
Glass reinforced plastic (GRP)	
Kevlar	
Composite materials	
Photochromic	

Week 4: Modern materials

1. Which **one** of the following statements is **false**? [1]
- ◇ Nanomaterials are between 1 and 1000 nanometres in size
 - ◇ Graphene is a carbon lattice structure one atom thick
 - ◇ Biodegradable polymers are made from petrochemical resources
 - ◇ Information is transmitted down fibre optic cables using pulses of light
2. Name **three** different modern materials and describe **one** use for each. [6]

3. Explain why LCD screens are appropriate for use in a battery powered metronome? [3]



4. Explain why biodegradable polymers are considered to be CO₂ neutral. [3]

5. How might metal foams be beneficial to patients receiving orthopaedic implants? [2]

Week 5: Smart materials

1. Which **one** of the following smart materials **does not** react to electricity? [1]
- ◇ Shape memory alloy
 - ◇ Quantum tunnelling compound
 - ◇ Thermochromic pigment
 - ◇ Piezoelectric material
2. Which smart material can be both a conductor and an insulator? [1]

3. Explain **one** disadvantage of using photochromic particles with self-darkening glasses. [2]



4. Describe how self-healing polymers could be useful in the construction of plastic frames for glasses and sunglasses. [2]

5. Use the following key words to create a short paragraph that explains the process that self-healing concrete undergoes when activated. [3]

Water – bacteria – stress – calcium carbonate – spheres – food – cracks

6. The following question is about the shape memory alloy, nitinol.

(a) Nitinol is an alloy of nickel and which other metal?

[1]

(b) How is a shape 'set' in to the memory of nitinol?

[2]

(c) A piece of Nitinol has a shape 'set' in its memory.

Explain what stimulus is required to return the material to its 'set' shape, once deformed.

[1]

(d) Name and briefly describe **one** commercial use of nitinol.

[2]

Week 6: Composite materials

Task 1

- (a) Explain why carbon fibre reinforced plastic (CRP) is used in sports equipment, motorsport vehicles and safety equipment such as helmets.



- (b) Why is a release agent applied to a mould or former before it is used for shaping GRP products?

- (c) What does the term 'cure' mean when working with reinforced plastics?

- (d) What are the health and safety precautions you should take when using resins that contain high levels of volatile organic compounds?

Task 2

GRP and CRP are frequently used for batch produced products such as boat hulls. Why do you think they are not often used for mass produced or one-off products?

Task 3

Label and annotate the picture of the police officer in full riot gear, explaining which elements of the uniform and protective equipment could benefit from composite materials or technical textiles. Justify each of your responses.



Week 7: Systems approach

1. Which **one** of the following components is used to detect light levels? [1]
- ◇ LED
 - ◇ Thermistor
 - ◇ LDR
 - ◇ Resistor

2. Which **one** of the following is an output component? [1]
- ◇ Speaker
 - ◇ PTM switch
 - ◇ Pressure pad
 - ◇ Microphone

3. Explain the functional difference between a closed loop system and an open loop system. [2]

4. This question is about connecting components together in a circuit.
- (a) What is the name for the style of circuit drawn below? [1]

- (b) Which electronic component is labelled **SW1**? [1]

- (c) Which electronic component is labelled **D1**? [1]

- (d) Explain the function of resistor **R1**. [2]

(e) Split the timing circuit below into **three** blocks by drawing two vertical lines across it.

Label each of the blocks, stating whether it is the **input**, **output** or **process**.

[3]

