AQA GCSE

Design and Technology 8552

5

Composite materials and technical textiles

Unit 2

Energy, materials, systems and devices

PG ONLINE

Objectives

- Understand how material properties can be enhanced by combining two or more materials
- Recognise a range of composite materials and technical textiles
- Understand how fibres can be manipulated to create technical textiles

What is a composite material?

- What materials are used to make concrete?
  - How can concrete be made even stronger to resist compressive forces?

Types of reinforced plastic

- Glass reinforced plastic (GRP)
- Carbon fibre reinforced plastic (CRP)
  - What are the main the differences between the two types of reinforced plastics?
  - For which applications might CRP function better than GRP?
  - Both methods use thermosetting resins which produce volatile organic compounds (VOCs)
  - A catalyst is added to the resin to make it harden or ‘cure’
- What precautions should you take when working with VOCs?

GRP (CRP) process

- Step by step process to construct a GRP (CRP) part

1. Prepare the mould or former
2. Apply a release agent to the mould
3. Apply a gel coat for GRP (or first resin coat for CRP)
4. Apply the glass fibre matting (or woven carbon fibre)
5. Work a second coat of resin into the material
6. Repeat layers of matting and resin coats to achieve correct thickness for the specific application
7. Clamp and leave a GRP workpiece to cure (Seal a CRP workpiece in a vacuum bag and heat in an oven to cure)
8. Release from the mould, trim and finish workpiece

Worksheet 5

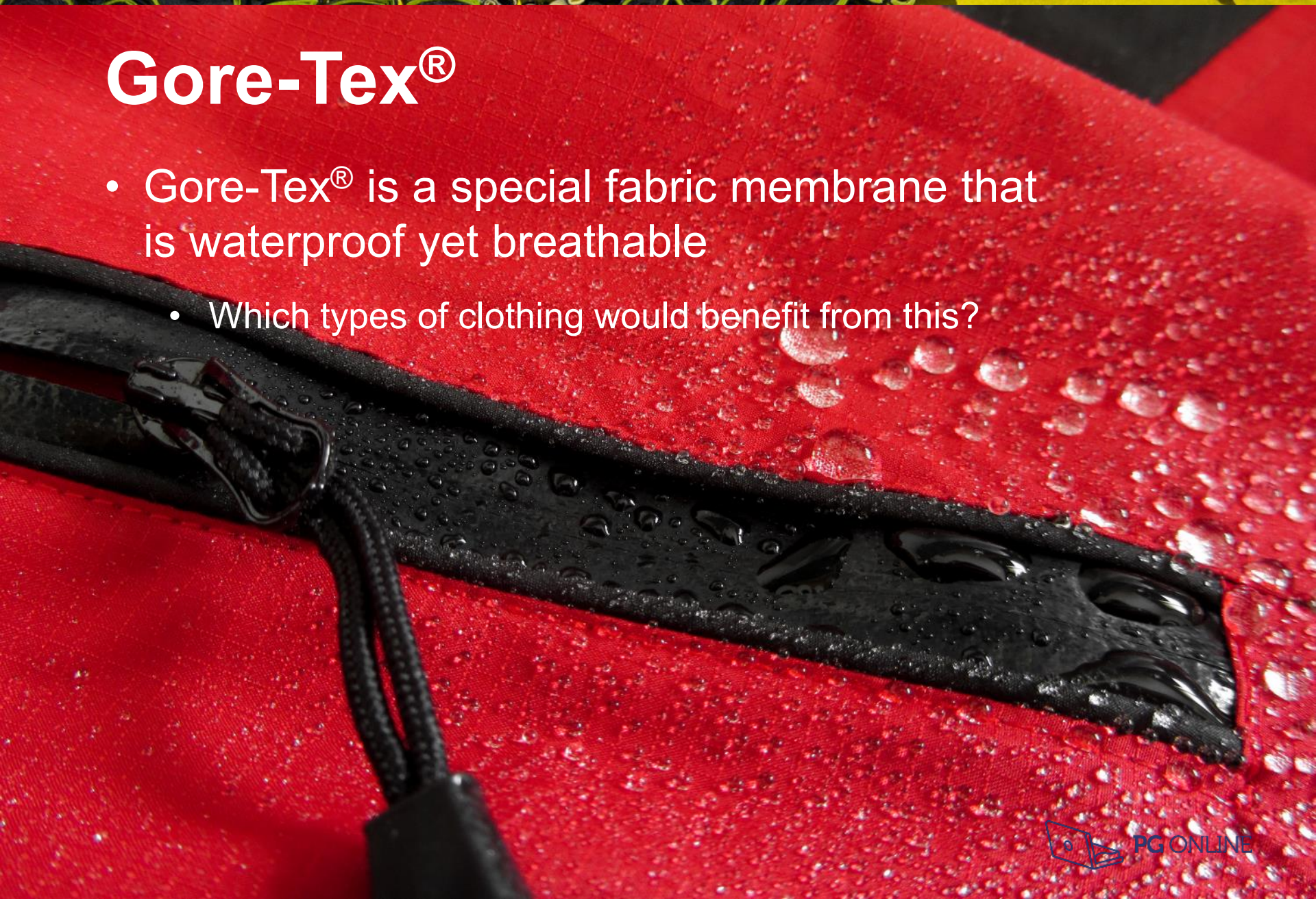
- Complete **Tasks 1** and **2** of the worksheet

Technical textiles

- The increased functionality of a technical textile can include:
  - Weatherproofing
  - Strengthening
  - Adding conductivity and insulation, both thermally and electrically
- What protection would firefighters expect from their clothing?

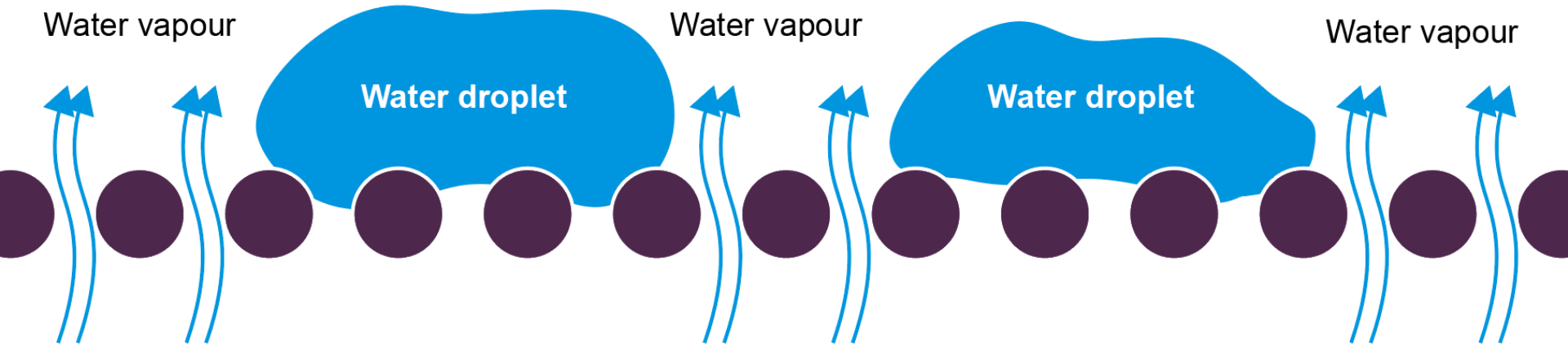
Gore-Tex®

- Gore-Tex® is a special fabric membrane that is waterproof yet breathable
  - Which types of clothing would benefit from this?



How Gore-Tex® works

- The membrane has 150 million holes per cm^2
  - This means water droplets are too big to pass through
  - Perspiration can still escape as water vapour



Aramids (Aromatic polyamide)

- Aramids are particularly tough fibres made from modified polyamide
- They offer:
  - Cut and tear resistance
  - Flame proofing
  - Thermal insulation
  - High strength
  - A hard wearing finish
- Nomex® and Kevlar® are both types of aramid

Flameproof or flame retardant

- What is the difference?
  - How are sofas and bedding protected from catching alight?

Conductive fabrics and threads

- E-textiles allow electricity to travel along special threads which are either woven or sewn into fabrics
  - Stainless steel or other conductive strands are mixed with other fibres providing flexibility
  - The thread can be soldered onto special sew-on components
- How might conductive thread be used to operate touch sensitive electronics in Arctic conditions?

Microfibres

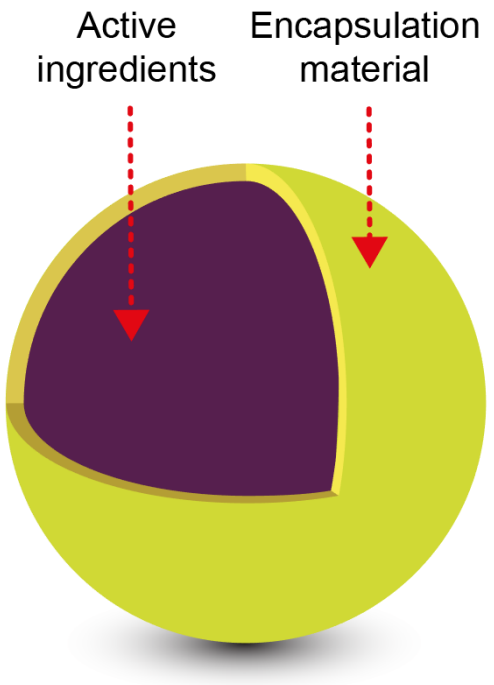
- Microfibres are less than one denier thick - that's one fifth the width of a human hair
  - They create an electrostatic charge that attracts particles of dust
  - Usually made from polyester and polyamide
- Which common products contain microfibres?

Microfibre: good or bad?

- Microfibre is a very useful material, however:
  - It can be flammable unless treated
  - It is synthetic and not renewable
  - It takes many years to decompose
- There is growing evidence that microfibres are causing oceanic pollution and entering our food chain

Microencapsulation

- Solids, liquids or gasses are sealed in tiny capsules
  - These active ingredients can be released at controlled rates and under controlled conditions
- Active ingredients include:
  - Thermochromic dyes
  - Antibacterial material
  - Pesticides
  - Perfumes
  - Pharmaceuticals



Plenary

- Using your knowledge of composite materials and technical textiles, complete **Task 3** of the worksheet

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