For each of the selection charts listed below, select one question and answer it based on what you can learn from the chart. Type your answer directly below the question, then delete the extra questions so I can find the answer easily. Upload your completed assignment to the LMS>

**Young's Modulus - Density**

* Which polymers float?
* Why do brass and copper have similar properties?
* Why are designers trying to use composites in aircraft?
* What problems might there be in using wood for a bike frame?
* Wood, aluminium and composites have all been used for pole vaulting at various times - what makes them all suitable?
* Why might balsa be used in model-making? What other factors might you need to consider?
* Identify and discuss three examples combining light weight materials and shape for packaging.
* Why have both wood and steel been used for joists? What might affect your choice of wood?

# Young's Modulus - Cost

* What applications might require low stiffness materials?
* Paper has the same Young’s modulus as oak – so why do people think it’s not as stiff?
* Since wood is not that cheap, why was it used so much until recently?
* Since composites don’t appear to provide stiffness at low cost - why are they used?
* Why is lead used as ‘flashing’ to keep water out of buildings (e.g. roof/chimney joins).
* What is different about urea formaldehyde compared to the other polymers on the chart that makes it the stiffest?
* Why are ceramics, such as silicon carbide, used for machine tool tips?
* Foams are stiffer than rubbers (why?), but not as strong as rubbers (why?). What are the implications for suitable applications?

# Strength – Density

* Many aluminium alloys are heat treatable – what does this mean and how is strength affected?
* Select materials for a rucksack.
* Select materials for a car wheel.
* Why are forged alloy components often stronger than cast ones?
* Explain at a molecular level why low density polythene has a lower density than high density polythene

# Strength - Toughness

* Why does prestressed concrete have high tensile strength?
* Select materials for a child’s cup or spoon.
* Select materials for a 13A plug casing for a vacuum cleaner.
* Select materials for a bullet/knife proof vest.
* Select materials for a bus shelter window.
* Thermal toughening of glass places the surfaces in compression the interior in tension - why does this increase the strength?
* Is rubber tough or brittle (hint: remember the balloon experiment)?

# Strength - Elongation

* What is the difference between elastic and plastic deformation?
* Why is lead used on old roofs and roof flashings?
* Select materials for a car bumper.
* Select materials for a bungee rope.
* Select materials for drawing pins.
* Why can’t rubbers be formed into shapes easily, even though they can be subjected to large deformations?
* Why is wood used for beams rather than stone, when stone has a higher strength?
* Why is pottery weak?
* Why is steel the most commonly used ‘strong’ material?
* Select materials for a screwdriver.
* Select materials for a glass-cutting tool.

#### Further Questions

* Why can polymers operate only at low temperatures when their polymer chains contain covalent bonds like ceramics?
* What is the operating temperature of a light bulb filament?

# Strength - Max. service temperature

* Why is lead-tin used for solder?
* Select materials for a saucepan.
* Select materials for a mould for casting aluminium parts (melting temp 660oC)
* Select materials for a mould for casting steel parts (melting temp 1540oC)

#### Further Questions

* Why can polymers operate only at low temperatures when their polymer chains contain covalent bonds like ceramics?
* What is the operating temperature of a light bulb filament?
* Explain why bike frames are made from steel, aluminium alloy or carbon-fibre reinforced plastic?
* Select materials for a tennis racquet.
* Select materials for a canoe.
* Select materials for a cast for a police truncheon.

#### Further Questions

* Why are cast-iron cooking pans among the best when they are the heaviest?
* Why are composites used more widely for sports goods than elsewhere?

# Recycle Fraction - Cost

* Why is brick heavily recycled?
* How is steel separated from other metals for recycling?
* Select materials for a disposable cup.
* Select materials for a pizza box.
* Select materials for a car body.

#### Further Questions

* Why are aluminium drinks cans heavily recycled despite their low weight?
* Ink jet cartridges are good examples of disposable items which are best reused rather than recycled, can you think of others?

# Energy - Cost

* Why is it economic to recycle aluminium cans but less so for steel ones?
* Why will new reserves of minerals/oil which are not now economic to mine become economic in the future?
* Select materials for a wall/fence around your house.
* Select materials for fast-food restaurant eat-in plates, trays, etc
* Select materials for bedding for cattle.

#### Further Questions

* Why doesn’t energy produced by wind-turbines lead to global warming?
* Why is the controlled burning of polymers an environmental option to landfill?
* Give one application where diamonds are used in industry and explain why.