Name: Jack Maguire 47/62 76%

A level Engineering

End of chapter 5, unit test.

Time: 45min

Total marks: 62

Q1: Complete the table below. For each example, ensure you name a property that makes it appropriate for your stated application :

Material	Classification	Key property	Example application
Tungsten carbide	Non-Ferrous Alloy	Very Dense	Drill Bit
Aluminium	Non-Ferrous Element	Corrosion Resistant	Drinks can
Brass	Non-Ferrous Alloy	Low Friction	French Horn
Mild steel	Ferrous Alloy	Easy to cast	Vice
Urea Formaldehyde	Thermoset	~~Opaque~~ Rigid	~~Milk Bottle~~
LDPE	Thermopolymer	Light	Plastic Bag
Polypropylene	Thermopolymer	Can be coloured	Playground Slide
HIPS	Thermopolymer	High impact resistance	Vacuum - formed speaker
Pine	~~Softwood~~ Hardwood	Can be treated for outdoor use	Outdoor furniture
Plywood	Laminated Manufactured Board	Tensile strength in both x and y axes	cheap wooden toys
Oak	Hardwood	Very strong	Cladding
Balsa	Hardwood	Very lightweight	Model Planes
Thermochromics	Smart Material	Returns to original shape when heated.	Baby Spoon
SMA	Smart Material	Change colour when heated.	Spectacles
Goretex	Modern Material	Breathable via a semi-permeable membrane.	Ski Gloves
GRP	Thermoset Composite	Water-Resistant	Boat hull exterior
Polyester (fabric)	Woven Fabric	Water-Resistant	Coat
Cotton	Woven Fabric	Durable	Shirt.

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(One mark for each classification and a second for a key property and matching application)

Concrete is a composite F41

Plug (that goes into a socket)

Q2: Define the following terms:

Ductility The ability for a material to be stretched (eg. into a wire) without snapping.

(2) 2

Hardness The ability for a material to resist surface deformation when a force is applied.

(2) 2

Biodegradability The ability for a material to degrade over a short period of time without the use of external chemicals like solvents.

(2) 1

Q3: Give an example of a property for each of the following headings:

Mechanical property Durability ✗

Chemical property Corrosion Resistance ✓

Physical propery Density ✓

Manufacturing property Machinability ✓ (4) 3

Q4: Using an example or set of examples that you are familiar with, explain how a design/engineer could consider a range of design factors in the manufacturing of an item.

In your answer, discuss:
- Ethics
- Social impacts
- Cultural impacts

There are many design factors that go into the design of a pan for use in domestic settings.

Firstly, the designer should consider the ethics of their manufacture. Whilst pans covered in teflon are relatively safe to use at home (with only a small number of incidents occuring outside expected use), there are many problems with the manufacture. Workers can suffer serious injuries from the fumes, and due to improper disposal the surrounding areas can also suffer. The designer should also consider the environmental impact of their base input, like how Aluminium takes lots of energy to refine.

The designer should also consider social factors like their target market. If it is in an area (like Italy) that cooks lots of acidic foods (like tomatoes) over a long time, the designer might need to enamel their cast iron pan, or they might need to design pans with tall walls to minic East Asian Woks. They should also consider the prevalence of electric vs gas stoves in their target markets, as only certain materials work on induction stoves.

(8) 6

Finally, the designer should consider the cultural impact of the release of their cookware. If a Western brand (like Le Creuset) were to release a set of pans for the Korean market and they became incredibly popular, this might decrease the prevalence of more traditional dishes which favoured traditional cooking implements, having an impact on the future of the local cuisine.

...s: the image shows a foldable electric scooter. Add annotation to the image justifying the material and finish choices. In your answer cover:

- The main metallic sections
- Polymer sections both internal and external
- The tyres/handlebars

(8) 6

The handlebars are likely made from polypropylene due to its low cost, ease of colouring and durability for the handlebars.

The tyres are likely made from a plastic like high density polyethylene to provide the strength and durability necessary for the product, whilst lacking stiffness which allows the tyres to also act as shock absorbers, reducing costs and easing manufacture.

These wires for the electric motor controls ~~wires~~ are likely insulated in ~~PVC~~ Polyvinyl Chloride as it is an electrical insulator.

~~and is heavy~~

and the handlebar post

The base of the scooter is likely made of mild steel.

~~Mild steel is cheap, which~~

This is due to the following:

- Low price: more appealing to consumer.
- High durability: will last for a long time.
- Ease of manufacture: can be welded to provide a strong bond

All of the metal parts of the scooter have likely been powder-coated, as it is an easy way to completely cover even awkward shapes like the hinges in paint. It also provides a barrier against rusting and other forms of corrosion.

The plate on top of the base is likely made from a rubber material, in order to increase the grip of the scooter to make it safer.