

VIKTORIA BERGES

1908705

MATERIALS AND INTRODUCTION
TO PROCESSING

ACMA 4000

22/01/2021

1) Requirements:

- water light
 - recyclable
 - expiration date
 - wear resistance
 - taste retention
 - non-toxic
 - durability
 - cheap
 - light
 - non-reactive to any ingredient of the food.
- printable

The best option would be recycled plastic which can be recycled again. Paper bag could be another option however they won't be durable even they include some kind of plastic film inside.

The ^{best} ~~most~~ environmental option would be if these snacks were stored in containers in the shops and the customers would take their own containers, paper bags etc to buy them

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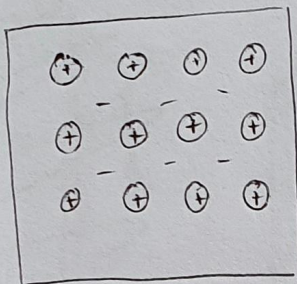
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Q) 2.

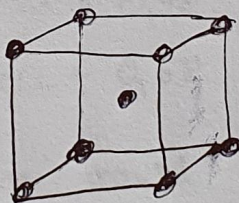
a)



Metallic bonding: primary interatomic bonding; sea of electrons. Valence electrons are not bound to any particular atom in the solid. These free electrons hold the ion cores together.

More electrons on outshell increase the electrostatic power.

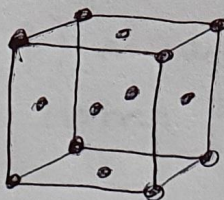
b) BCC - body centered cubic structure.



BCC unit cell has atoms at each of 8 corners of a cube plus one atom in the centre

The corner atoms are corners of another ~~so~~ cubes so they are shared among 8 unit cells.
~~Coordination~~ Coordination no 8.

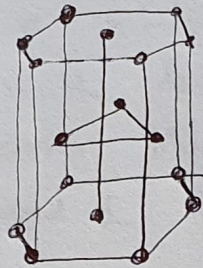
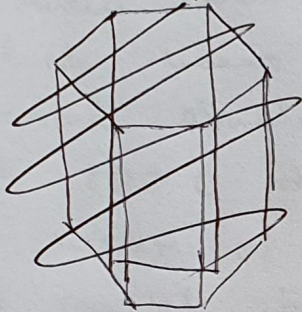
FCC - Face centered cubic structure



Each corner atom is shared among 8 unit cells, a face centered atom belongs to only 2.

One-eighth of each of the eight corner atoms and one-half of each of the 6 face atoms, or total of 4 atoms. Coordination no 12.

HCP - Hexagonal closed packed structure



The unit cell is of hexagonal geometry and is generated by the stacking of close-packed planes of atoms.

So top and bottom faces consists of 6 atoms that form regular hexagons and surround a single atom in the centre. Another plane provides 3 additional atoms. Coordination n° 12.

c) packing ratio for of HCP = 0,78
BCC = 0,68

d) At 1800°C the mixture would be in liquid state, the melting point is at 1670°C . *
As the mixture starts cooling down will get into the $\beta + L$ phase at 1650°C which means it won't be pure liquid anymore and will contain solid titanium (β) as well.
* At 1670°C it crosses the liquidus line and starts to solidify.
Around 1500°C it crosses the solidus line which means under this line the system becomes completely solid.

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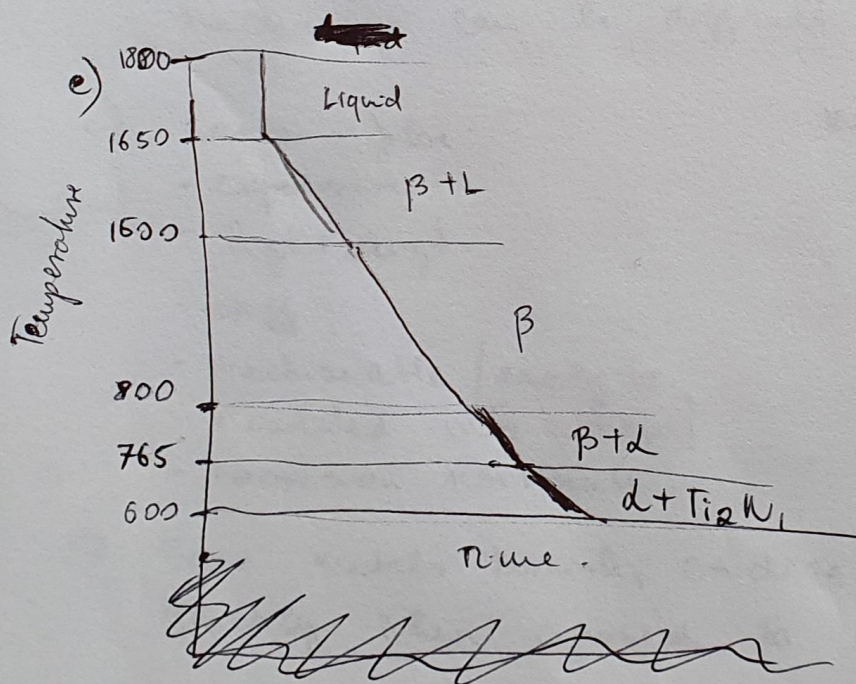
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Between 1500°C and 800°C is the β phase which means solid Titanium that has BCC crystal structure with less packing ratio.
At 800°C it crosses the boundary and becomes a mixture of β and α both solid difference in the crystal structure.
At 765°C as cools down will cross the eutectic line and under that line becomes the mixture of $\alpha\text{Ti} + \text{Ti}_2\text{Ni}$.



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5) a) If the aim is to maximise stiffness/density

I would consider the following classes.

Composites, technical ceramics and metal as
according to the chart these materials have
the best ratio

b) I wouldn't consider natural materials or
metals. Natural materials are flammable, not
strong enough. Metals ~~are~~ can be too heavy,
plus corrosion ~~and some of them are~~ plus
machining can be difficult.

c) Carbon fibre:

- expensive
- lightweight
- stiff
- machineable / easily be
moulded into shape
- corrosion resistance

Aluminium as space frame:

- corrosion resistance
- ductility
- lightweight
- malleability

d) Base metals tarnish, oxidize, corrode relatively
quickly when exposed to moisture

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c) Bonding: using special adhesive to basically glue parts together. Advantage: no deformation on the materials, cost reduction, fast, improving of design, flexibility

Riveting: fastening parts together using rivets, clips

Advantage: ability to dismantle or service, ~~durability~~ durability, flexibility, cost effectiveness.

4) a) It's used to store and transport the breathing gas.
Needs to be watertight, corrosion resistance, durable, non toxic, refillable, wear resistance, shape retention, light.

b) Best choice probably aluminium if ~~the design~~ ~~that~~ it's not a deep sea dive.

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$$c) \quad \sigma = \frac{Pd}{ht} \quad t = \frac{2Pd}{\sigma_{yield}}$$

$$\sigma = \frac{200 \cdot 10^6}{h \cdot 0,1}$$

Aluminum:

$$t = \frac{2 \cdot 200 \cdot 10^6 \cdot 100}{241 \cdot 10^6} = 16,6 \text{ mm}$$

$$\sigma = \frac{200 \cdot 10^6 \cdot 100}{h \cdot 16,6} = 301,2 \cdot 10^6 \text{ MPa}$$

steel. $t = \frac{2 \cdot 200 \cdot 10^6 \cdot 100}{210 \cdot 10^6} = 19,4 \text{ mm}$

$$\sigma = \frac{200 \cdot 10^6 \cdot 100}{h \cdot 19,4} = 257,7 \cdot 10^6 \text{ MPa}$$