

Ichen Morgan Mech Exam
(2014/08)

1)

A)

$$\frac{5WL^4}{384EI} = I = \frac{5WL^4}{384EA}$$

$$= \frac{5 \times 10000 \times 5^4}{384 \times 200 \times 10^9 \times 0.005}$$
$$= \frac{31,250,000}{384 \times 10^9} = 8.14 \times 10^{-5}$$

B)

$$\frac{bd^3 - b^3d}{12}$$

$$b = 0.15$$

$$d = 0.25$$

$$h = 0.1$$

$$T = 0.005$$

$$= \frac{0.15 \times 0.25^3 - 0.1^3 (0.15 - 0.005)}{12}$$

$$= 1.83 \times 10^{-4} \text{ (Beam not sufficient)}$$

$$b = 0.5$$

$$d = 0.5$$

$$h = 0.25$$

$$t = 0.1$$

$$= \frac{0.5 \times 0.5^3 - 0.25^3 (0.5 - 0.1)}{12}$$

$$> 4.6 \times 10^{-3} \text{ (Beam not sufficient)}$$

$$b = 0.5$$

$$d = 0.5$$

$$h = 0.25$$

$$t = 0.5$$

$$= \frac{0.5 \times 0.5^3 - 0.25^3 (0.5 - 0.5)}{12}$$

$$= 5.2 \times 10^{-3} \text{ (Beam sufficient)}$$

C) Ichen Morgen Markt Lern
(20/10/18)

$$M_{\max} = \frac{10,000 \times 3^2}{8.14 \times 10^{-5}} = 31,250 \text{ N/m.}$$

$$\frac{31,250 \times 5}{5.2 \times 10^{-3}} = 30.04 \text{ MPa.}$$

$$D) 30.04 \times 5 = 150.2.$$

E) $150.2 \times 5 = 751$, I would choose 751^{MPa} as
my minimum allowable ~~be~~ yield strength

F) To use cheaper steel I would make
my dimensions bigger to compensate for the
cheaper steel.

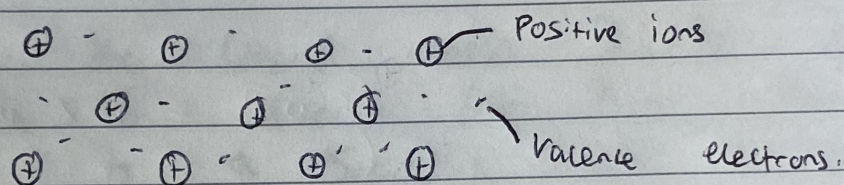
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2)

(Bear Sent by email)

3)

a) Metallic bonding is seen as a cloud of positively charged ions within a cloud of valence electrons.



The valency determines the number of atoms that are reacting twice each other in compounds. Metals with a valency of two are generally stronger than those that have one. This is due to having more 'free electrons' and are capable of adding more to the metallic bond, therefore strengthening the metal.

b) Left Crystal Structure = Body Centred Cubic (BCC)
~~Left~~ Right Crystal Structure = Simple Cubic Crystal.

c) FCC = 0.74
HCP = 1.633
BCC = 0.68.

Iron (201108) Mangan (201108) Manganese

D) The mixture would be liquid.

(I)

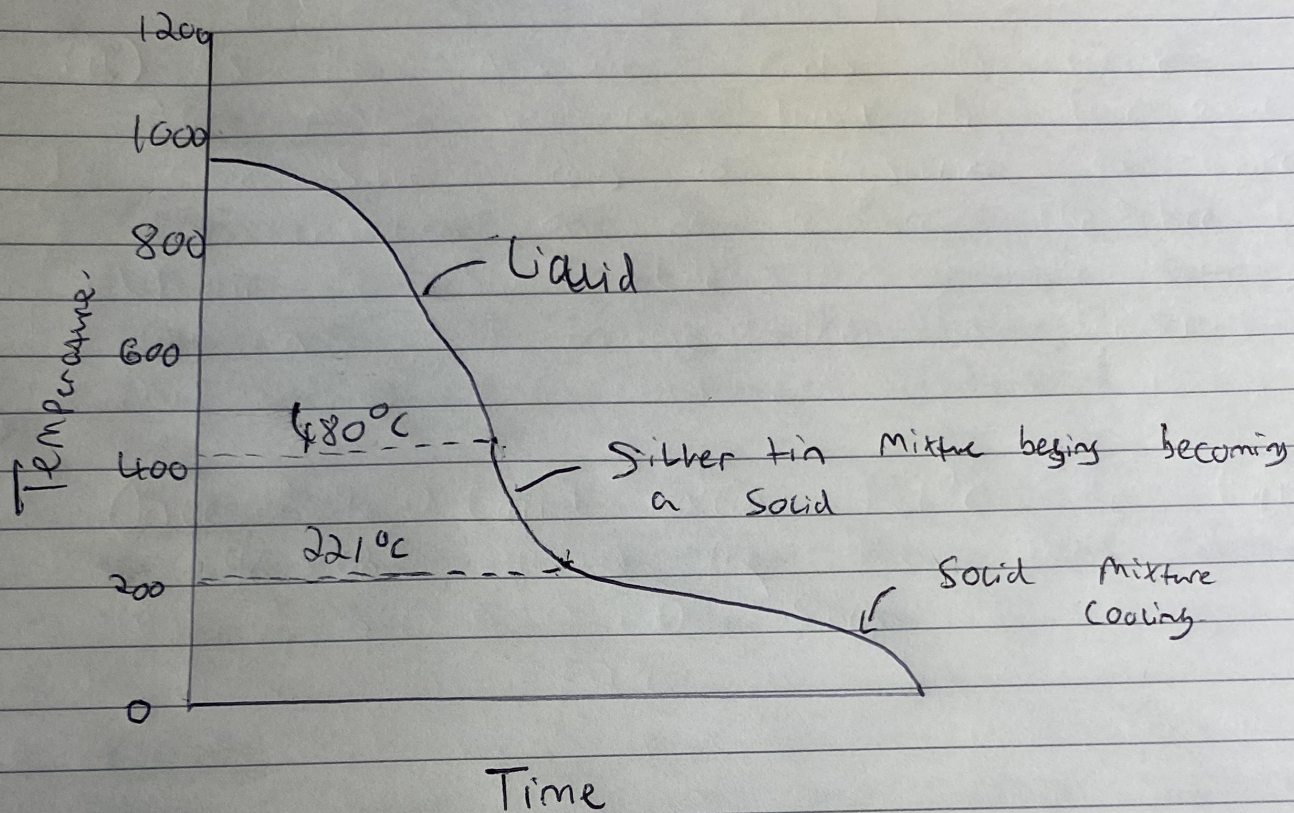
(II) As the mixture cools to 420°C , the mixture will remain liquid. The face centred cubic silver begins to crystallize at 420°C and crystallizes out of the BCC. The BCC will follow the sloped line meaning the percentage of tin will increase. The tin becomes more pure.

Once the liquid reaches 221°C the liquid is 96.5% pure. At this point the mixture is a solid since the melting point of tin is 232°C .

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e)

Cooling Curve

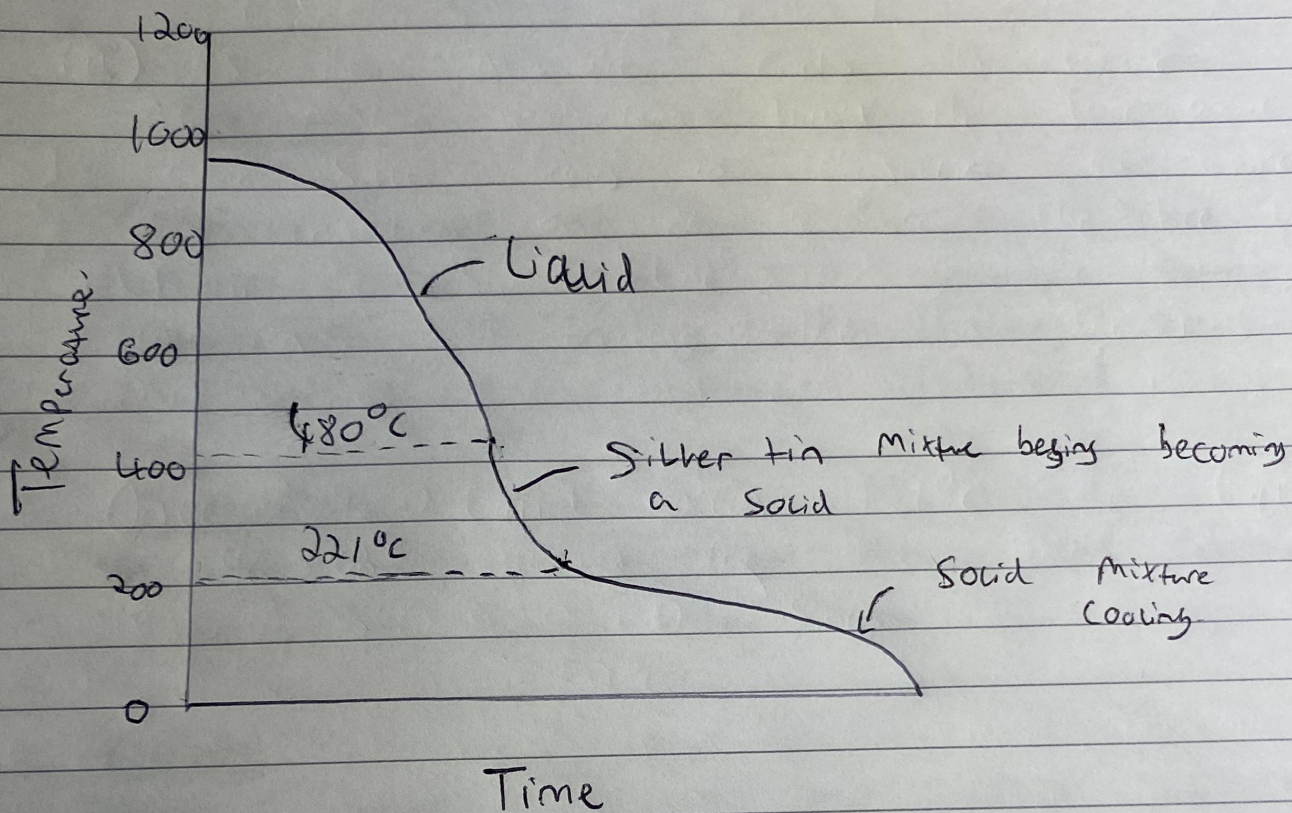


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e)

Cooling Curve



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(201408)

(4) For this Project I would Consider
a) Ceramics, Composites and Metals.

Ceramics

Ceramics would be great due their Great Properties. These include, High melting Points, Hardness and Strength, Good durability and a low thermal and electrical conductivity.

Composites

Good resistance to Creep Fatigue and Corrosion.
Cheap, hard wearing and light.

Metals

Metals would be a good choice due to its Cheap Price, Mechanical Strength, accessibility and easy Formations.

B) I would not Consider Foams, Natural Materials and Polymers.

Foams

I would not choose Foams due to its Properties. The foam will be too weak to hold the weight of the Camera and won't be able to handle the harsh temperatures of Mars.

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Polymers

Considering Polymers will have a high resistance to chemicals, it still does not have the strength required for this build.

Natural Materials.

Natural materials will not be chosen for this build due to wood not having the durability required to form Mars. Also Mars' low temperature will make the wood shrink from its original size.

4 c) ?

4 d)

If I have to choose Titanium as my chosen material, here's the process I would use to ensure my camera mount was as accurate and as strong as possible.

I would first use a Renishaw AM500Q Machine to 3D Print. The parts needed to create the stand. The AM500Q machine uses far less to melt titanium powder into different shapes, overtime creating parts. This is known as additive manufacturing.

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I would use a Cnc laser welding machine to weld ~~the~~ my parts to ensure my welds were as accurate as possible.

Once the Part is complete. The Part will be placed on a CMM Machine Fitted with a Renishaw 1m Probe. This will ensure all measurements will be as accurate as possible. The Probe will have an accuracy of 1um.