

THOMAS HUGHES. 1909575

22 JAN 2021

PAGE 1

QUESTION 1

REQUIREMENTS.

- * THE PACKAGING MUST BE AIR TIGHT.
- * THE PACKAGING MUST BE NON-TOXIC.
- * THE PACKAGING MUST BE ABLE TO PRINT ADVERTISEMENTS I.E. PRINTABLE
- * THE PACKAGING MUST BE STRONG ENOUGH TO AVOID DAMAGE WHICH WOULD AFFECT INTEGRITY OF PRODUCT.
- * THE PACKAGING MUST BE COST EFFECTIVE / CHEAP AS MOST ARE MASS PRODUCED.
- * A RECYCLABLE MATERIAL
- * NEEDS TO BE LIGHT FOR COST + TRANSPORT PURPOSES / LOW DENSITY
- * SHOULD BE ODORLESS SO NOT TO CONTAMINATE
- * MUST BE DUCTILE

POTENTIAL MATERIAL CHOICES

- * Cardboard Packaging - THIS CHOICE IS RELATIVELY COST EFFECTIVE BUT WOULD REQUIRE A COMBINED MATERIAL I.E. PLASTIC LID. IF WATER IN CONTACT WITH WATER IT WOULD LEAD TO DAMAGE THEREFORE IS NOT A CHOICE WOULD USE - ALSO NOT VERY STRONG CARDBOARD IN NOT GOOD FOR PRINTING
- * PLASTIC - THIS CHOICE WOULD DISPLAY GOOD STRENGTH TO WITHSTAND TRANSPORT, CAN EASILY BE PACKAGED TO REMAIN AIR TIGHT IF CHOSEN WITH THE CORRECT PLASTIC LIKE HDPE IT IS WIDELY RECYCLED AND HIGHLY COST EFFECTIVE WOULD NOT REQUIRE ANY OTHER MATERIAL TO MANUFACTURE ALSO KEEPING COSTS.

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22 JAN 2021

PAGE 2

TIN - IS EXTREMELY STRONG, CAN HOLD LIQUID OR FOOD. TIN IS EXCELLENT MATERIAL TO RESIST CORROSION AND NARROWS ONLY OF ITS ORIGINAL MATERIAL WHEN MELTED. TIN IS FAR MORE EXTENSIBLE THAN THE OTHER CHOICES. TIN IS PRINTABLE WITH AN USM AND OTHER MATERIAL COMPOUND

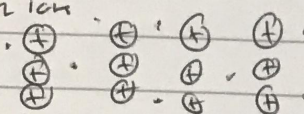
~~BIO DEGRADABLE~~BIO DEGRADABLE CARDBOARD

THIS CHOICE IS EXTREMELY RECYCLABLE, IS EXTREMELY LIGHT AND CAN BE PACKAGED AIR TIGHT. RESEARCH HAS SHOWN ITS EASY TO PRINT ON IT IS DYEABLE SO WOULD WITH SPAN TRANSFER. ~~CAN BE~~

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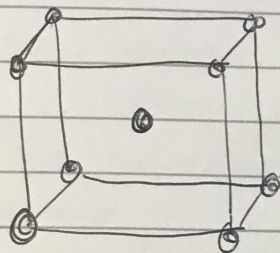
22 JAN 2021

PAGE 3

QUESTION 2. ^{met ion}  - DEGENERATED IONS

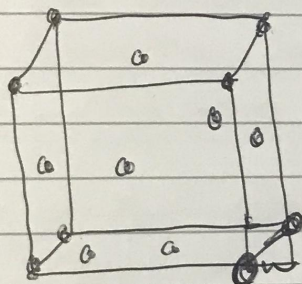
a) METALS WITH A HIGHER VALENCY HAVE MORE ATOMS PER ATOM ON THE OTHER SIDE. INCREASES REACTION WITH OTHER COMPOUNDS - IT ALSO HAS A HIGHER MELTING POINT.

b) BCC =



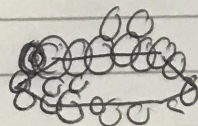
HAD ATOMS ON EACH OF 8 CORNERS PLUS ONE ATOM IN THE MIDDLE.

fcc =



IT ALSO HAD ATOMS AT EACH 8 CORNERS BUT HAS 6 ATOMS AT THE FACE OF EACH CUBE

HCP =



fcc + hcp PACK ATOMS AT TOP TO ANOTHER TOP AND BOTTOM PLANE OF 6 ATOMS FORMING REGULAR HEXAGON AROUND CENTRE AND EVEN LIKE EACH OTHER

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22 JAN 2021

PAGE. 4

ACMA Ratio

$$c) \text{HCP} = 0.74$$

$$\text{BCC} = 0.68$$

d) i. At 1800°C the mixture is liquid.

ii. $1650^\circ\text{C} = \beta + L$ THE LIQUID IS A MIX OF BOTH METALS
 At this temperature we have mix of solid Ti mixed with liquid. This is like a slush mix of ~~the two~~ the two. ~~the~~ Ti.

WE CAN DESCRIBE THIS AS A TWO PHASED REGION AS THERE ARE TWO PHASES THAT ARE PRESENT AT THIS POINT THIS WOULD BE A BCC STRUCTURE PHASE.

iii. ~~1600~~ 800°C - At this temperature we have (β Ti)

~~and~~ ~~is~~ ~~a~~ THE METAL IS STILL IN A SOLID FORM

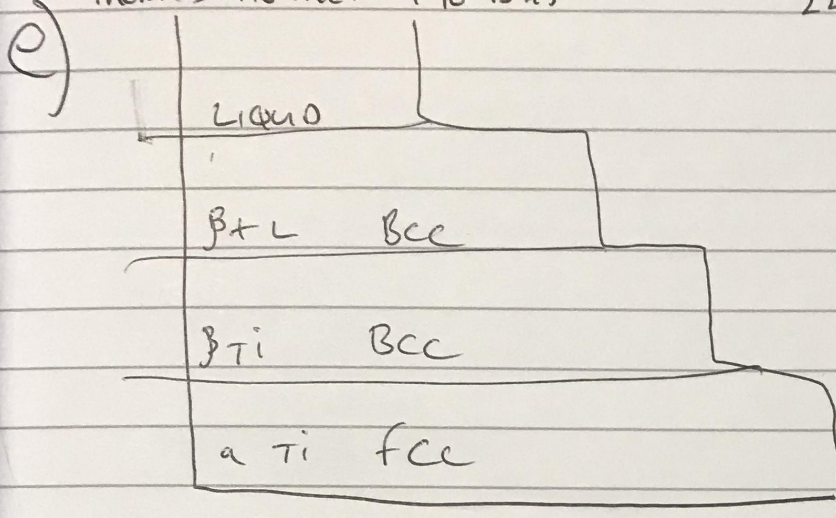
THE MATERIAL IS NOW A BCC STRUCTURE

iv. 600°C At this temperature we have solid
 THIS HAS NOW CHANGED TO A HCP STRUCTURE

THOMAS MUKHERJEE 1909525

22 JAN 2020

PAGE 5



QUESTION 3

a) CONSIDER THESE

ALUMINIUM - IS MACHINABLE TO TIGHT TOLERANCES
 HAS HIGH YOUNG'S MODULUS
 IS LOW DENSITY COMPARED TO OTHER
 METALS. HAS LOW DUCTILITY TO ABSORB
 IMPACT

CARBON FIBRE - EXCELLENT STRENGTH IS LIGHTER
 - THINER MOST MATERIAL IN THIS AREA
 - MATERIAL IS BRITTLE AND IS
 EXTENSIVE

B4C - HIGH STIFFNESS
 - STRONG
 -

THOMAS HUGHES 1909575

22 JAN 2021

PAGE # 6

Question 3 ~~would~~ would not consider the following

- b - Wood - - MA difficult to manufacture to tight tolerances
- Natural material - IS brittle
- IS FLAMMABLE
- No. Very ~~brittle~~ ductile

or

- B4C - THIS MATERIAL ALTHOUGH EXTREMELY STRONG
- IT IS BRITTLE - LOW DUCTILITY.
- DIFFICULT TO MANUFACTURE TO TIGHT TOLERANCES.
- THIS IS ALSO EXTREMELY EXPENSIVE MATERIAL

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22 JAN 2021

PAGE 7

- c) CARBON FIBRE ~~ANY~~ IS A LIGHTER MATERIAL THAN STEEL
 THERE WOULD BE USES OF FIBRE AS CAN LESS LIKELY TO
 RECEIVE IMPACT - FRICTION OF CARBON FIBRE WOULD BE LESS THAN
 STEEL - CARBON FIBRE IS ALSO BRITTLE SO COULD NOT WITHSTAND
 IMPACT

STEEL IS A TENSILE MATERIAL AND HAS A HIGHER
 YIELD STRENGTH

- d) THE BASE METAL'S PROPERTIES ARE AFFECTED DURING
 WELDING PROCESSES - ~~THE~~ DUE TO JOINING TWO METALS IT
 PRODUCES THE FATIGUE STRENGTHENING THIS WOULD ALSO
 HAVE A NEGATIVE IMPACT ON ITS DUCTILITY.

BA BRAZING

BRAZING IS OFTEN DEEMED A HIGHER QUALITY
 BECAUSE -

- IT REQUIRES A FAR LESS TEMPERATURE THAN WELDING
 HAVING LESS IMPACT ON PROPERTIES SUCH AS FATIGUE, TENSILE
 DUCTILITY.

- e) FASTENING - RIVETS
 MIG WELDING - METAL INERT GAS.

Thomas Holmes 1907595

22 JAN 2021

Page 8

QUESTION 4

a) THE MATERIAL SHOULD HAVE THE FOLLOWING

- GOOD THERMAL PROPERTIES TO DEAL WITH CHANGE IN TEMP
- HIGH FATIGUE STRENGTH
- NON-CORROSIVE
- TOUGH TO WITHSTAND IMPACT
- NON-TOXIC

b

6062 T6 - ~~LOW STRENGTH~~, ~~NOT STRONG ENOUGH~~

7075 ALUM - NOT STRONG ENOUGH AND IS ALSO TOO HEAVY (DENSE)
THIS MATERIAL IS CORROSIVE

304 - REALLY STRONG BUT IS ALSO UNSUITABLE DUE TO ITS WEIGHT - USUALLY USED IN HEAVY APPLICATION

6061 ALUMINUM - IS THE STRONGEST CHOICE AND ALSO HAS TO LOWEST DENSITY - IS NON CORROSIVE

~~THIS WOULD BE MY CHOICE DUE TO ITS LIGHTNESS AND WEIGHT (DENSITY)~~

MY CHOICE WOULD BE ALUMINUM BECAUSE OF COST

ITS LIGHTWEIGHT AND EASY OF MANUFACTURE AND CORROSIVE

c ~~2 x 20 x 10^6~~

~~ALUM~~ $\epsilon = \frac{2 \text{ Pd}}{\sigma_{\text{YIELD}}}$

$$= \frac{2 \times 20 \times 10^6 \times 100 \times 10^6}{241 \times 10^6}$$

$$= \frac{2 \times 2000}{241 \times 10^6}$$

$$= \frac{4000}{241 \times 10^6}$$

$$= 16.6 \times 10^{-6} \quad | \quad 16.6$$