

Lesson 4 - Metals and alloys

Task 1

Look at the grid and fill the gaps in the following text:

Property	Metals
Appearance	Shiny (lustrous)
State at room temperature	Solid (except mercury, which is a liquid)
Density	High (they are heavy for their size)
Strength	Strong
Malleable or brittle	Malleable (they bend without breaking)
Conduction of heat	Good
Conduction of electricity	Good
Magnetic material	Only iron, cobalt and nickel
Sound when hit	They make a ringing sound (they are sonorous)
Magnetism	Iron, cobalt, nickel and some of their alloys are magnetic. The other metals are not

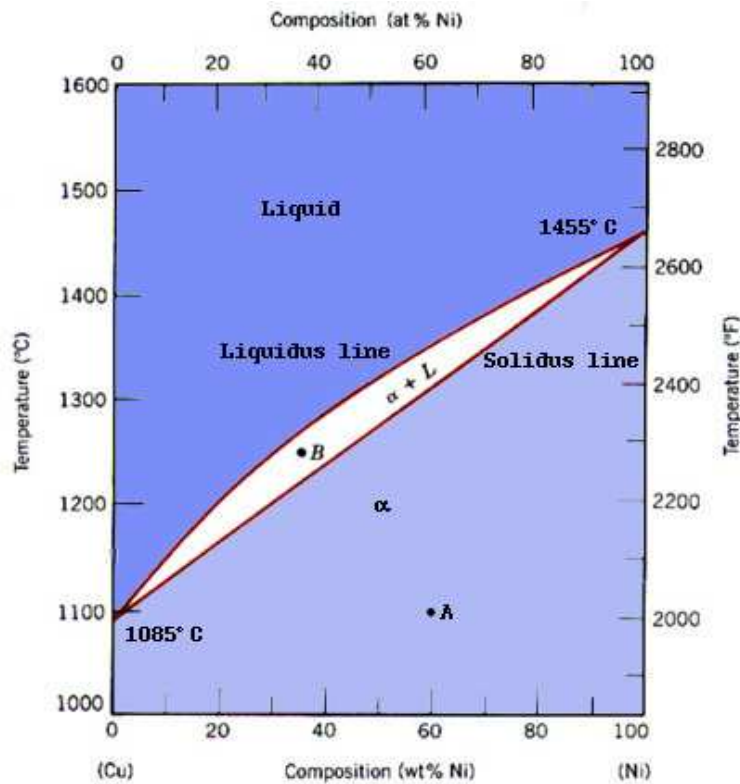
Metals have these **properties** in common:

- they are _____ or _____, especially when they are freshly cut
- they are good _____ of heat and electricity
- they can be _____ without breaking (they are _____)
- they are _____ at room temperature, except _____, which is a liquid at room temperature
- they have a high _____ (they feel heavy for their size)
- they make a _____ sound when they are hit (they are _____)
- Three metals are _____. These are _____, cobalt and _____. Steel is a mixture of elements but mostly iron, so it is also _____. The other metals are not magnetic.

Task 2

The following chart is a binary phase diagram of Copper-Nickel alloy (Cu-Ni). Using a ruler, fill the gaps in the following grid (the possible states are α , liquid or α + liquid):

% Cu	% Ni	T (°C)	State
20		1100	
50		1300	
unknown	unknown	1500	
unknown	unknown	1050	
	60	1400	
	5	1150	
	40	1200	



Look task

Task 3

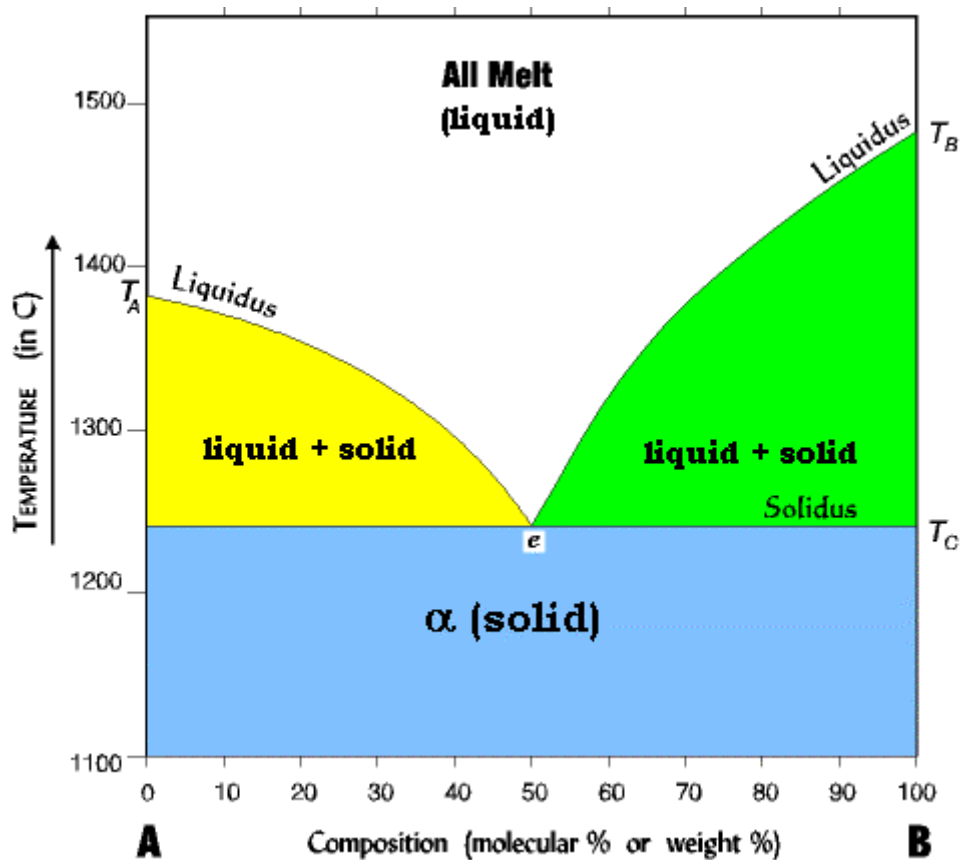
at the chart of 2 and work out:

- What is the melting point of copper (Cu)?
- What is the melting point of nickel (Ni)?

- c) At which temperature is the solidus line located when the alloy has a 30% nickel composition?
- d) At which temperature is the liquidus line located when the alloy has a 20% nickel composition?

Task 4

The following chart is a binary eutectic phase diagram of an alloy:



Complete the following text with the provided words:

1. The *liquidus* line separates the _____ phase from the liquid + solid phase.

2. The *solidus* line separates the _____ phase from the all solid phase.
3. The _____ is the point at which all three _____ can exist simultaneously, solid, liquid + solid, and liquid. The eutectic here is 50% B, but can be any percent depending on the alloy.
4. *Solidus* and _____ lines are experimental, they have been determined by melting and cooling many alloys at different percent _____.

Provided words (there are two spare):

liquidus liquid + solid melt phases
solidus compositions line eutectic

Task 5

Using the following substitution table write two right sentences about the binary eutectic phase diagram provided above.

For pure	B	(far	left	of the diagram)	the melting temperature is	T _B ,	about	1380°
	A		right			T _A ,		1485°