Lesson 4 – Metals and alloys
Teacher's notes

- ✓ The students must have the handouts with the power point presentation in front of them in order to take notes on them.
- ✓ In slide 2, the materials shown are steel (spanner), copper, aluminium (foil) and brass (yellow) + steel (padlock)
- ✓ **Vocabulary to be learnt**: *spanner, copper, aluminium, brass, padlock, ore, stepped slopes, pick and shovel, waste, adit, shaft, declined shaft, alloy, solid solution, intermetallic compound, cooling curve, melting point, molten*
- ✓ **Structures to be learnt**:
  - ✓ *metals have to be extracted from the ore,*
  - ✓ *a roof collapsed causing seven fatalities,*
  - ✓ *surface mining methods maintain exposure to the surface throughout the extraction period,*
  - ✓ *to extract the ore below the surface,*
  - ✓ *highly mechanized operation,*
  - ✓ *the metal solidifies,*
  - ✓ *the temperature drops*

Task 1

Iron, magnesium and gold are examples of metal elements.

All metals have these **properties** in common:

- they are shiny, especially when they are freshly cut
- they are good conductors of heat and electricity
- they can be bent without breaking (they are **malleable**)

Most metals have these properties:

- they are solid at room temperature, except mercury, which is a liquid at room temperature
- they are hard and strong
- they have a high **density** (they feel heavy for their size)

- they make a ringing sound when they are hit (they are **sonorous**)

Three metals are **magnetic**. These are iron, cobalt and nickel. Steel is a mixture of elements but mostly iron, so it is also magnetic. The other metals are not magnetic.

Task 2

% Cu	% Ni	T (ºC)	State
20	80	1100	α
50	50	1300	α + liquid
unknown	unknown	1500	liquid
unknown	unknown	1050	α
40	60	1400	liquid
95	5	1150	liquid
60	40	1200	α

Task 3

a) 1085ºC
b) 1455ºC
c) 1200ºC
d) 1200ºC

Task 4

1. The *liquidus* line separates the all melt phase from the liquid + solid phase.
2. The *solidus* line separates the liquid + solid phase from the all solid phase.
3. The eutectic is the point at which all three phases 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 *liquidus* lines are experimental, they have been determined by melting and cooling many melts at different percent compositions.

Task 5

1. For pure A (far left of diagram) the melting (crystalizing) temperature is TA about 1380º.
2. For pure B (far right of diagram) the melting (crystalizing) temperature is TB about 1485º.