Lesson 9: C10.9 – Alloys and Useful Materials

Connection

Q1. Which two substances can cause rusting?

Q2. Write a word equation for a reaction between copper and oxygen.

Q3. What is a reaction with oxygen called?

Activation

LI: Describe and interpret the composition of alloys and evaluate their uses.

1. https://www.youtube.com/watch?v=KgUmNQD6m5Q
2. Make a note of the title and the LI
3. Read pages 340-341
4. Define 'Alloy'

Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C10 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C10.9 – Alloys and Useful Materials

Connection

1 Water and Oxygen
2 Copper + Oxygen → Copper Oxide
3 Oxidation

Demonstration

1a X since it has the highest carbon content.
1b Y since it has the lowest carbon content.
2 X 50 units (the higher the carbon content the stronger the steel)
Y 27 units (the lower the carbon content the softer the steel)
Z 35 units
3 Copper: 5309 g. Tin: 280 g. Phosphorus: 11.2 g.
4 By varying the percentages, the properties of the alloy are varied e.g. hardness, melting point.
This means that the alloy can be tailored to a specific need.
5 The pewters containing 4% and 15% lead. Lead is toxic.
6 There will be less distortion of the metal layers since there is a smaller percentage of other
metals. The layers can therefore more easily slide over each other.
7a Titanium is very reactive and would react with the oxygen in air.
7b 280 g

Lesson 10: C10.10 – Ceramics, Polymers and Composites

Connection

Q1. What is an alloy?

Q2. Which two metals make bronze?

Q3. What happens to the properties of pure metals when added to eachother?

Activation

LI: Compare glass, ceramics, polymers, composites and metals and be able to select materials according to their properties and required use.

1. https://www.youtube.com/watch?v=EP0zfm_FVqc
2. Make a note of the title and the LI
3. Read pages 342-343
4. Define 'Composite and Polymer'
5. What is a reinforcement material?

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C10 DIP file

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C10.10 –Ceramics, Polymers and Composites

Connection

1 two or more metals bonded together
2 copper and tin
3 The properties change

Demonstration

1 Soda-lime composition: sand, sodium carbonate, limestone. Borosilicate glass: sand, boron trioxide. So both contain sand but differ in the number and identity of the other components.
2 It contains glass fibres – the reinforcement – and a (polyester) resin which is the matrix (binder).
3 The long polymer chains are linked by cross-links. The appearance is like a net.
4 Drinks bottles need to be moulded so the plastic has to be soft when heated up. Also, drinks bottles need to be be flexible. Thermosetting plastic tends to be hard and brittle.
5 Polymer: It is too flexible (lower number equals greater flexibility) and its low density means that it would not withstand impacts very well (although it would be light).
Ceramic: This is too rigid and inflexible and would likely shatter in an accident.
6 On balance, the polymer would be the best choice with glass fibre coming second. The polymer has high tensile strength, is very flexible and has a relatively low density. Glass fibre has the highest tensile strength but is not as flexible and has 3 times the density.

Lesson 11: C10.11 – Haber Process

Connection

Keyword Spelling Test – Pick 10 keywords in the topic to test spelling.

Activation

LI: Explain how commercially used conditions in the Haber process are related to cost, and how to control the equilibrium position and rate.

1. https://www.youtube.com/watch?v=1_HoWz5Kxfk
2. Make a note of the title and the LI
3. Read pages 344-345
4. Define 'Haber Process, Equilibrium, Reversable reaction'.
5. Write down the word equation for ammonia.

Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C10 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C10.11 – Haber Process

Connection

Check Spellings

Demonstration

1 Nitrogen and hydrogen.
2 Nitrogen and hydrogen are purified. They are reacted together at high temperature and pressure
to form ammonia. The remaining nitrogen and hydrogen is recycled back to the start.
3 Cryogenic (fractional) distillation of air. The air is liquefied by cooling to low temperatures. Then it
Is fractionally distilled. This is carried out several times to remove oxygen, since oxygen damages
the catalyst.
4 Reacting methane (from fossil fuels) and steam without any sulfur present produces hydrogen.
5 Water, H_2O. Vast quantities available.
6a As pressure is increased, the position of equilibrium moves to the right (to the side with fewest molecules). So the percentage yield of ammonia increases with increasing pressure, whichever temperature is selected.
6b Since the reaction is exothermic, a lower temperature moves the position of equilibrium to the right. So the lower the temperature the greater the percentage yield of ammonia.
7 The graph shows that the percentage yield does not greatly increase above 200 atmospheres. Also, the higher the pressure the more expensive it is to build a plant due to safety considerations. Higher pressure also requires more energy to sustain.

Lesson 12: C10.12 – Production and use of NPK Fertilisers

Connection

Q1. Which two elements make ammonia?

Q2. What is meant by reversable reaction?

Q3. What is meant by increasing yield?

Activation

LI: Describe how fertilisers are produced both industrially and in the laboratory and compare the processes.

1. https://www.youtube.com/watch?v=K7NbkVdOTxg
2. Make a note of the title and the LI
3. Read pages 346-347
4. Draw Figure 10.42

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C10 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C10.12 – Production and use of NPK Fertiliser

Connection

1 Hydrogen and Nitrogen
2 To be able to get back the products you started with
3 Increase amount of product produced

Demonstration

1 Pour the ammonia solution into the conical flask using a measuring cylinder. Add the sulfuric acid

Solution to the burette. Add an indicator (e.g. universal indicator) to the flask. Run the sulfuric acid into the conical flask until the indicator changes to the desired colour (green for universal indicator). Methyl orange is a more effective indicator.

2a Potassium phosphate.
2b Ammonium sulfate.
3 A calcium phosphate + nitric acid → calcium nitrate + phosphoric acid
3 B phosphoric acid + ammonia → ammonium phosphate

Ammonia from the Haber process is used to produce nitric acid. Nitric acid is used in reaction B.

Ammonia is used in reaction C. Phosphoric acid from reaction B is reacted with ammonia in reaction C.

4 Vast quantities of artificial fertiliser are made every year. Phosphate rock is central to the process.

Phosphate rock is a finite resource and will eventually run out.

5 $CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O + CO_2$
6 $Ca_3(PO_4)_2 + 6HNO_3 \rightarrow 3Ca(NO_3)_2 + 2H_3PO_4$

Revision

Connection

Q1. list 3 ways of enriching the soil

Q2. What are the steps for making a fertiliser salt?

Q3. What is meant an N:P:K fertiliser?

Activation

LI: Create a topic summary sheet

1. Fold an A3 sheet so it is divided into 8 sections
2. Look back over you lesson and group them into 8 main headings
3. Summarise the key points into each section, use keywords and diagrams and symbols rather than sentences

Demonstration

Test yourself by working with the person sitting next to you by talking though each box on your summary sheet and seeing how many key facts you can remember

Consolidation

Look though the relevant past paper questions for this topic - From the C10 DIP file – see if you can complete any additional questions

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C10 Revision

Connection

1 animal manure, natural mineral deposits, synthetic fertilisers

2 use burette to titrate acid into alkali until a neutral solution is produced, evaporate off the water to produce crystals, filter the remainder of the liquid from the crystals

3 It's the ratio of nitrogen (growth), phosphorous(fruit/flowers) and potassium (chlorophyl/photosynthesis) present

C10 DART Safe water?

Read these reports on cholera and typhoid outbreaks, then answer the questions.

Between 19 August and 30 September 1854, 616 people died of cholera in Westminster, London. That is roughly 100 deaths per week.

Dr. John Snow investigated the outbreak in order to determine the source of the infection and to stop the terrible death toll rising still further. He reported that: 'A gentleman in delicate health was sent for from Brighton to see his brother at 6 Poland Street, who was attacked with the cholera and died in 12 hours, on 1 September. The gentleman arrived after his brother's death and did not see the body.

He only stayed about 20 minutes in the house, where he took a hasty and scanty luncheon of rump steak, taking it with a small tumbler of brandy and water, the water being taken from the Broad Street pump. He was attacked with cholera on the evening of the following day, 2 September, and died the next evening.' Snow also heard of a lady from Hampstead, via her son: 'A cart went from Broad Street to West End every day and it was (the lady's) custom to take out a large bottle of water from the pump in Broad Street, as she preferred it.

The water was taken on Thursday 31 August, and she drank it in the evening and also on Friday. She was seized with the cholera and died on Saturday ... a niece, who was on a visit to this lady, also drank the water; she returned to her residence, in a high and healthy part of Islington, was attacked with cholera and died also.' After Snow presented this evidence, the pump handle was removed and the epidemic ended.

Quality standards for drinking water are relatively modern. Chlorine was not routinely added to water supplies in all parts of the country until war broke out in 1939. Waste water (sewage) was still not treated with chlorine. Until the late 1960s Bristol's raw sewage was pumped into the River Avon untreated.

In Croydon, in 1937, there had been an outbreak of typhoid. Some men had been working in a well from which a large portion of the town was supplied piped water. Whilst the work was going on, the water was being pumped out and used, but was not being filtered and chlorinated in the usual way.

It is believed that one of the men, a typhoid 'carrier' had relieved himself in, or near, the well and the typhoid passed into the water. This disaster prompted the water industry to reconsider many of its practices and the importance of employing properly qualified scientific staff.

Questions:

1a. When and where did the cholera outbreak take place?

1b. What did John Snow try to determine when he conducted the investigation?

1c. State Dr Snow's findings

2a. Identify a common piece of evidence that supported Dr Snow's conclusion.

2b. State the death rate caused by the cholera infection

2c. Describe the trail of evidence that led to the conclusion that the water pump handle was the cause of the contamination.

3a. List reasons for the cause of the 1937 typhoid outbreak in Croydon.

3b. Evaluate the need for Quality Standards agencies in light of the two out breaks

3c. Discuss the actions taken by the water industry following the typhoid incident.

Answers:

1a. Between 19 August and 30 September 1854, in Westminster, London.

1b. The source of the infection

1c. He concluded the water pump in Broad Street was the source of the infection

2a. both victims drank water from the same pump.

2c. The first piece of evidence concerned a victim who was reported to have died after a visit to pay his respects to his brother who had died from cholera. It was reported that he had drunk water obtained from the Broad street water pump. The second piece of evidence was obtained from the death of a lady who routinely drank water from the same source every day. The one thing both victims had in common was the source of the water which led Dr Snow to his conclusion.

3a. e.g. The drinking water supply was untreated with chlorine. The water was contaminated with sewage.

3b. e.g. The first outbreak in 1854 led only to the change of the water pump itself. No other risk assessment appeared to have taken place. A quality standards body might have evaluated other risks and thus prevented other similar outbreaks

3c. Following this incident the water industry looked in detail at different aspects including the employment of qualified scientists, establishing risk assessment procedures and being answerable to the Water standards agency.

Attainment Band :	C10 Sustainable development (AQA) Knowledge and Understanding
Yellow Plus/ Yellow	Extract and interpret information about resources from charts, graphs and tables. Explain what is needed to provide potable water for all. Compare the ease of treating waste, ground and salt water. Evaluate alternative biological methods of metal extraction. Carry out a simple comparative LCA for shopping bags. Evaluate ways of reducing the use of limited resources. Explain methods for preventing corrosion. Evaluate the uses of other alloys. Explain how the properties of materials are related to their uses and select appropriate materials. Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate. Compare the industrial production of fertilisers with laboratory preparations of the same compounds.
Blue	Distinguish between finite and renewable resources from given information. Describe the differences in treatment of ground water and salty water. Describe how sewage is treated. Describe the process of bioleaching. Interpret LCAs of materials or products from information. Explain why recycling, reusing and reducing are needed. Interpret results of experiments on rusting. Interpret the composition of other alloys from data. Compare properties of glass and clay ceramics, polymers, composites and metals. Explain the trade-off between rate of production and position of equilibrium. Explain how fertilisers are produced industrially.
Green	State examples of natural products that are supplemented or replaced by agricultural and synthetic products. Distinguish between potable water and pure water. Explain how waste water is treated. Describe the process of phytomining. Describe the components of a Life Cycle Assessment (LCA). Describe ways of recycling and reusing materials. Show that air and water are needed for rusting. Describe the composition of common alloys. Compare quantitatively the physical properties of materials. Apply the principles of dynamic equilibrium to the Haber process. Describe how to make a fertiliser in the laboratory.
White	Some elements of the above have been achieved