University Learning in Schools

Chemistry

The Engineer's Guide to Cleaning Up an Oil Company's Mess

Lesson Plans

The Brilliant Club
Department for Education
SUPPORTED BY MAYOR OF LONDON

Lesson Plan

Lesson 1 – How to Make Oil Useful
Learning Objectives: To introduce pupils to crude oil. Pupils will learn about what crude oil is, what hydrocarbons are in general, and how the products of crude oil are used in today's world. Pupils will also learn about how crude oil is extracted from the ocean.
Resources: - Printout of powerpoint slides - Workbook
Activities: - Powerpoint lecture. - Classroom discussions around pupils' understanding of petrol and diesel. - Speedy questions and answers. - Boiling point game- Students will get together in groups of varying sizes. Some students will be in groups of 2, some in 3 and some in fives. The point of this is that each group represents a hydrocarbon chain of similar size. The teacher then assigns a boiling point to each of these groups. E.g. Twos have a boiling point of 30 degrees, threes have 60 degrees and so forth. The groups all stand in the back of the class room and the teacher starts calling out the temperature of the class, increasing it with time. When the teacher calls out a temperature that is higher than the group's boiling point, they must come to front of the class. - Opportunity to fill in the workbook.
Pupil Assessment (include approach and expected outcome): - Pupils will not be formally assessed at this stage. They will be presented with homework to which the answers will be given on the following day. Pupils will then assess themselves and discuss problems that they may have. It is likely that not all pupils will discuss their difficulties with the teacher, but it is possible that they will discuss them within their own groups. Thus, time will be allocated for the pupils to discuss the answers amongst themselves, and then with the teacher. - The quick questions test will simply be assessed by a show of hands.

Lesson Plan

Lesson 2 – The Chemistry of Hydrocarbons
Learning Objectives: To introduce pupils to the concept of the chemistry of hydrocarbons. Pupils will learn about the different chain lengths of hydrocarbons present in crude oil. They will learn about intermolecular forces, and why these affect the boiling points of hydrocarbons. Thereafter, they will learn about how we can use these different boiling points to separate crude oil into its individual constituents.
Resources: - Printout of powerpoint slides - Workbook
Activities: - Powerpoint lecture. - Classroom discussions around boiling points. - Opportunity to answer questions in work book -
Pupil Assessment (include approach and expected outcome): - Pupils will not be formally assessed at this stage. They will be presented with homework to which the answers will be given on the following day. Pupils will then assess themselves and discuss problems that they may have. It is likely that not all pupils will discuss their difficulties with the teacher, but it is possible that they will discuss them within their own groups. Thus, time will be allocated for the pupils to discuss the answers amongst themselves, and then with the teacher. - The quick questions test will simply be assessed by a show of hands.

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Lesson 3 – Treatment Techniques for Petroleum Oil Waste Waters
Learning Objectives: Pupils will learn that crude oil refining produces petroleum waste water which would need to be treated before it can be disposed into the environment. They will also learn about the treatment techniques for the waste water, and methods about how to quantify the amount of pollution in the water.
Resources: - Printout of powerpoint slides - Workbook
Activities: - Powerpoint lecture. - Classroom discussions around ways to get rid of waste. Will be done in pairs. - Speedy questions and answers. - Video for treatment techniques.
Pupil Assessment (include approach and expected outcome): - Pupils will not be formally assessed at this stage. They will be presented with homework to which the answers will be given on the following day. Pupils will then assess themselves and discuss problems that they may have. It is likely that not all pupils will discuss their difficulties with the teacher, but it is possible that they will discuss them within their own groups. Thus, time will be allocated for the pupils to discuss the answers amongst themselves, and then with the teacher. - The quick questions test will simply be assessed by a show of hands.

Lesson Plan

Lesson 4 – Designing a Solution
Learning Objectives: Pupils will learn about the first method in conceptually designing a process on paper. By the end of the lesson, they should be able to translate a chemical process description to a block flow diagram
Resources: - Printout of powerpoint slides - Workbook
Activities: - Powerpoint lecture. - Classroom discussions around ways to get rid of waste. Will be done in pairs. - Speedy questions and answers. - Block flow diagram exercise.
Pupil Assessment (include approach and expected outcome): - Pupils will not be formally assessed at this stage. They will be presented with homework to which the answers will be given on the following day. Pupils will then assess themselves and discuss problems that they may have. It is likely that not all pupils will discuss their difficulties with the teacher, but it is possible that they will discuss them within their own groups. Thus, time will be allocated for the pupils to discuss the answers amongst themselves, and then with the teacher. - Block flow diagrams produced by the pupils will be evaluated in the classroom by the teacher-pupil pair.

Lesson Plan

Lesson 5 -- Process Economics
Learning Objectives: Pupils will learn methods to determine the cost of their process, and will thus be able to determine if a chemical process is economically feasible. Pupils will also be given the final assignment instructions in this lesson.
Resources: - Printout of powerpoint slides - Powerpoint presentation - Workbook
Activities: - Powerpoint lecture. - Speedy questions and answers. - Cost calculation exercise. - Final assignment objective discussion.
Pupil Assessment (include approach and expected outcome): - Pupils will not be formally assessed at this stage. They will be presented with homework to which the answers will be given on the following day. Pupils will then assess themselves and discuss problems that they may have. It is likely that not all pupils will discuss their difficulties with the teacher, but it is possible that they will discuss them within their own groups. Thus, time will be allocated for the pupils to discuss the answers amongst themselves, and then with the teacher. - Cost Calculations will be assessed by the pupil-teacher pair.

Lesson Plan

Lesson 6 -- Final Assignment Presentation Day
Learning Objectives: Pupils will deliver their proposed solution to the final assignment via a poster and powerpoint presentation
Resources: - Computer facilities
Activities: - Poster presentation - Poster viewing and discussions

Pupil Assessment (include approach and expected outcome):
 	
- Pupils will be assessed on their presentation in the following way:
  ○ Correctness of solution proposed
  ○ Communication ability of the team
  ○ Logical flow of content in presentation
 	
- Pupils will be assessed on the poster in the following way:
  ○ Poster aesthetics
  ○ Logical flow of information
  ○ Ability to convey the detail sufficiently
 	
- Pupils will also be assessed on their numerical answers to a problem set that will be given out to them in lesson 5
 	
Expected Outcomes:
Presentation & poster: Ability to convey their understanding of the problem and their solution in a concise but comprehensive manner
 	
Problem set: Demonstrates understanding of the maths and science behind the treatment processes for petroleum waste water.