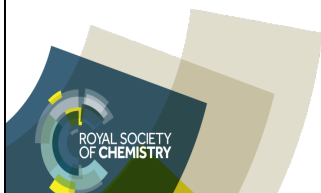


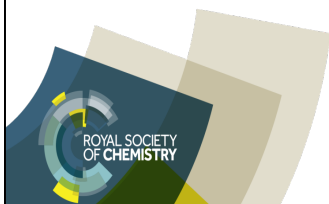
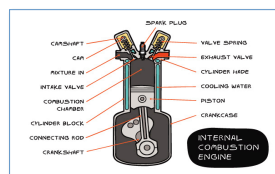
A Sticky Situation

Context-based Learning Exercise
for Chemistry Students



Context-Based Learning is about...

- Learning and applying chemistry in 'real world' situations/contexts
- Challenging students to consider chemistry and the context simultaneously
- Building knowledge, problem-solving, communication and team skills



Why are these skills important?

Employability Survey 2012

KKI Associates and the University of Edinburgh asked 6 major employers of chemistry, physics, and life science graduates what they looked in their recruits

Key findings – potential recruits need to be good at

Innovation

Working in team based activities

Problem solving

Working through formal project/process systems

Integrating their specialist knowledge with others

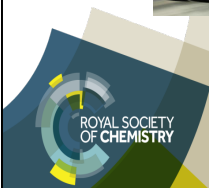
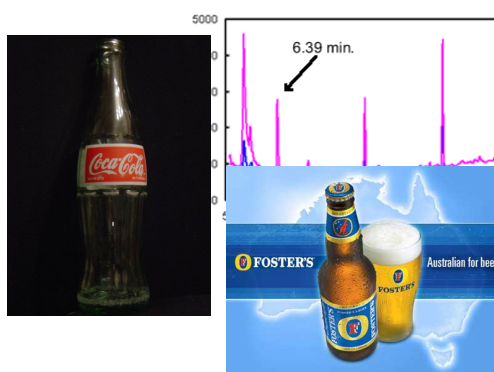
Communication Skills



See

<http://www.rsc.org/learn-chemistry/resource/res00000953/commercial-skills-for-chemists-introduction-and-overview>

Engine Oils are like beer or Coke...

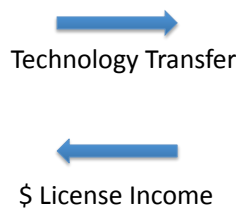


Brand Owner/formulator licenses formulations to blenders/distributors around the world

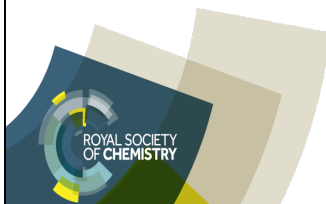
Our Company (Northland Petroleum)...



Northland Petroleum Oil



Hope N. Michael, Chairman GREED Corp



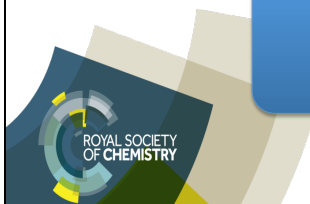
...has licensed our oil formulation to
*Global Resource Energy Exploitation and
Development Co in Australia*

Australia: September 2014



GREED Chairman is opening new
Ski Resort, his car breaks down
after the press conference...

He's not
happy...



October 2014

Northland Petroleum receive lawyers letter claiming damages (physical and reputational).

‘poor quality NP Oil responsible for engine failure’

Enclose pictures of oil ‘sludge’ inside engine





‘You have a call from the Chairman’

lawyers letter claiming
(physical and reputational)
‘poor quality NP Oil responsible for engine failure’

‘I need you to pull a team together, have a look at this situation and report back to me. What happened to that car? Do we fight or settle?’

That team is us!

Resource Structure

1. Setting the Problem
 - Billionaire's Car Breaks down in front of Press
 - 'NP Oil' Co are sued
 - Task Force to Investigate and recommend actions
2. Worksheets on:
 - How car engines work
 - How lubricants are formulated (2 parts)
 - Viscosity Index Improvers (2 parts)
 - View from the Car Makers
 - Extending Service Life
 - Testing the Oil
3. 3 Workshops
 - What happened?
 - Compare notes and gather information
 - Analytical tests
 - Integrative Exercise – report and recommendations

Your first task...(this workshop)

Read the material in the Case Study Briefing

1. *Make sure you understand the problem*
2. *Clarify anything with facilitators*
3. *Work out how you are going to do the worksheets*
 - *All together or 'divide tasks'*

Your next tasks...(independently)

Work through 8 worksheets...write a short memo for each one

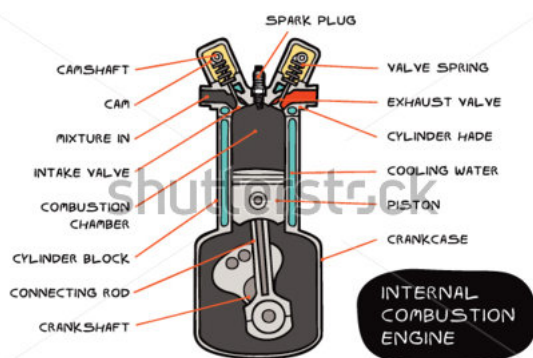
- 1. Answering the questions on them*
- 2. Analyzing which of these questions bear on the problem of the car*
- 3. Listing and discussing any potentially relevant sources you've found*

Worksheet Example – Internal Combustion

How do engines work?

Which parts will be physically hard to lubricate?

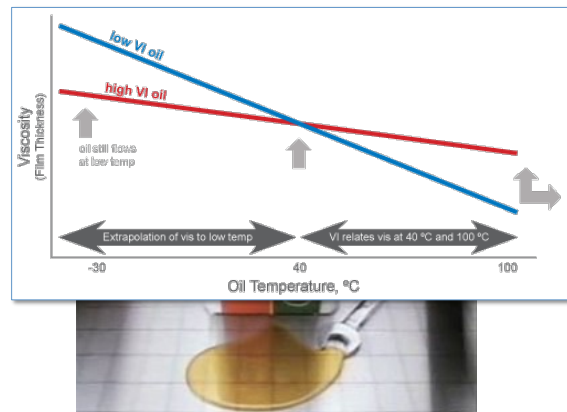
Where/how might chemistry be involved?



www.shutterstock.com · 76128310

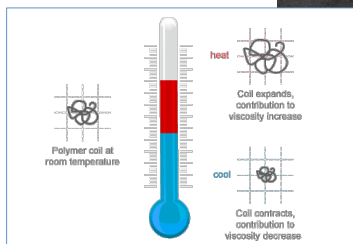
Worksheet – the properties and composition of Lubricating Oil

What's in the oil?
 What properties do we measure?
 What happens when it gets hot?
 What happens in use?



Worksheet – Viscosity Index Improver

What's in a VII?
 What determines polymer properties?
 What causes storage problems?
 What could we do to resolve this?



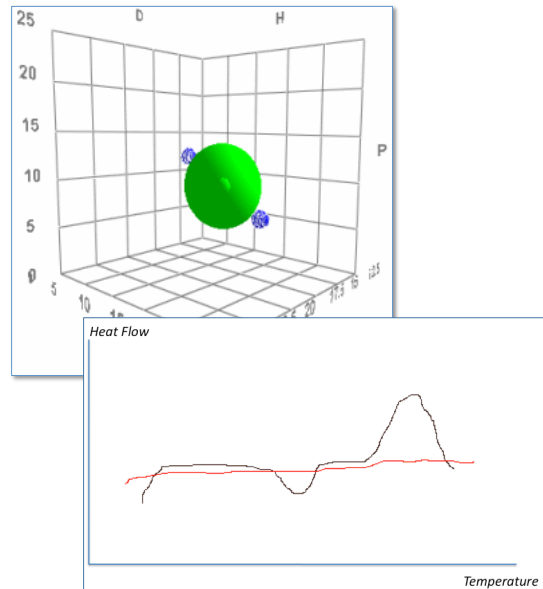
Worksheet – VI Improver part 2

What are crystalline and amorphous polymers?

What is 'Differential Scanning Calorimetry' (DSC)?

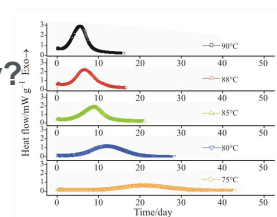
How do polymers interact with solvents?

What is the *solubility parameter*?



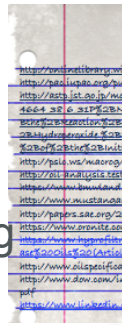
Worksheet - Extending Oil Life

- **Anti-wear additives**
 - Zinc dithiophosphates – what are they?
 - What do they do?
 - What happens in high sulphur fuels?
- **Antioxidants**
 - Mechanism of oxidative degradation
 - Chemistry of anti-oxidants
 - Base oil additive interactions
 - DSC tests
 - PAO vs XHVI



Other Information

- Articles
- 'Mysterious list'
 - on desk of missing employee
- Weather Forecast



Konigsberg in the Mountains

Special Feature: Petra Head

"She's a bit of a goer isn't she?" Hase Michael, commonly known by his nickname 'Open Mike' beams as we get out of his Konigsberg PTV at Saxon Valley in the Snowy Mountains. We're now at 6000 ft and the air is noticeably cleaner and cooler than at the bottom of the valley. It's a narrow road up to Michael's new ski development.

I wonder about taking coaches up here but Michael is laughing at me. "No we've blasted a nice wide highway through the Forest on the other side of the hill for them. We're going to keep this road as it is and only let cars on it. We're trying to get a minimum speed limit on it to encourage sports cars to come this way. After all you have black runs on the pistes so why not a black run access route?" I can't quite decide whether he's joking, but having seen a passenger in the drive up I'm I think he's probably serious.

The Supercar screamed as he hurried up the private road, that Michael has been sharing with a few motoring friends. He claims not to have raced but does admit to "comparing times now and then, just to see".

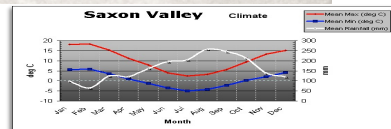


"They have some nice motors but nothing to touch this one with a hybrid twin turbo, KERS, and all the P1 stuff." Is it completely standard? I wonder? My last drive in a Konigsberg didn't seem quite as raucous and elemental as this one.

Michael looks a little evasive for a second before admitting: "We've touched nothing much really, just taken a few electrical things out of circuit, heaters (well we're in Australia) and all that sort of stuff. Doesn't really change the performance just helps the KERS recharge quicker".

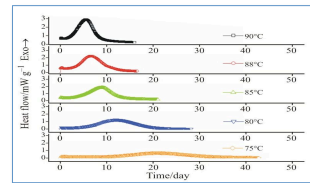
"Anyway, fancy taking the wheel on the way down?"

Fastest Gear Magazine Australia



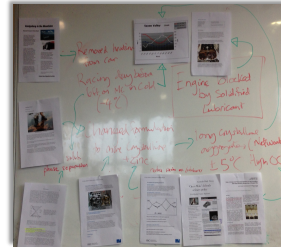
Second Workshop

- Should have finished Worksheets
 - and sent to facilitator for checking
- Share results with each other
 - (if not yet done so)
- Discuss potential reasons for engine failure
- You'll have a choice of oil samples and analytical techniques 'available'
 - select the ones you want



Third Workshop

- 'Analytical Results' back
- Develop narrative about 'what happened'
- Develop 'Schematic' of Factors
- Write the 'contents page' of your report to Northland Management



Report to Chairman

- **What happened?**
 - One or multiple factors?
- **Whose fault was it?**
- **Do we settle or fight court case?**
- **How to stop this happening in future**
 - Recommendations to reformulate oil
 - Recommendations to improve VII