

## C1 – Crude Oil Quiz

1. What is combustion?

A reaction between oxygen and a fuel that releases energy.

2. Which pollutant gases are produced during the combustion of fossil fuels?

Particulates, carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxides, water

3. What are the environmental effects of particulates, carbon dioxide, carbon monoxide, nitrogen oxides, and sulphur?

Global dimming (particulates travel into the atmosphere and reflect light back into space), global warming, suffocation, acid rain/asthma, acid rain.

4. Why are particulates and carbon monoxide produced when petrol burns?

Sometimes insufficient oxygen is available which means incomplete combustion occurs inside the engine.

5. Why are nitrogen oxides produced during the combustion of petrol?

Nitrogen and oxygen from the air react inside the combustion engine due to the very high temperatures inside the engine

6. How are carbon dioxide and sulphur dioxide produced when fossil fuels burn?

Carbon dioxide is produced from complete combustion of hydrocarbons. Some fossil fuels contain sulphur. This reacts with oxygen during combustion to form sulphur dioxide.

7. How are harmful substances removed from car exhaust fumes?

By fitting cars with catalytic converters. Carbon monoxide is converted to carbon dioxide, nitrogen oxides are converted to nitrogen and oxygen, and particulates are converted to carbon dioxide and water.

8. How is sulphur dioxide removed from industrial waste gases?

Chimneys are lined with calcium oxide or calcium hydroxide which neutralises the sulphur dioxide. This is called flue gas desulphurisation.

9. What are biofuels?

Fuels that are made from plant or animal products. Biodiesel is made from old cooking oil and plant oils. Biogas is made from fermenting animal waste.

10. What is crude oil?

A mixture of different hydrocarbons.

11. What is a hydrocarbon?

A compound made of hydrogen and carbon ONLY.

12. Describe how the different hydrocarbons in crude oil are separated.

Crude oil is heated to 350°C. Some of the hydrocarbons turn into vapour while others remain a liquid. The liquid flows to the bottom of the fractionating tower, the vapours rise up the tower. The temperature decreases as you rise up the tower. As the vapours cool they condense and are piped off. Some vapours don't condense and rise out of the top of the tower.

13. What is a fraction?

A mixture of hydrocarbons with similar chain length and boiling points.

14. What are the products of fractional distillation of crude oil?

Refinery gases, petrol, naphtha kerosene, diesel oil, fuel oil, lubricating oil, bitumen

15. What are the products of fractional distillation of crude oil used for?

Refinery gases for camping gas, petrol as car fuel, naphtha as a chemical feedstock, kerosene as jet fuel, diesel oil as lorry fuel, fuel oil to heat houses, lubricating oil as engine oil, bitumen for road surfacing.

16. What are alkanes?

Saturated hydrocarbons with the general formula  $C_nH_{2n+2}$ .

17. Name the first 5 alkanes and give their formula.

Methane  $CH_4$ , Ethane  $C_2H_6$ , Propane  $C_3H_8$ , Butane  $C_4H_{10}$ , Pentane  $C_5H_{12}$

18. What is a homologous series?

A group of compounds with the same general formula that differ by a  $CH_2$  group from one member to the next.

19. What are alkenes?

Unsaturated hydrocarbons with the general formula  $C_nH_{2n}$

20. What is the difference between saturated and unsaturated hydrocarbons?

Saturated hydrocarbons have only C-C single bonds. Unsaturated hydrocarbons have C=C double bonds as well as C-C single bonds.

21. What are the similarities between alkanes and alkenes?

Both are hydrocarbons

22. What are the differences between alkanes and alkenes?

Alkanes are saturated and do not decolourise bromine water. Alkenes are unsaturated and decolourise bromine water. Alkanes have 2 extra hydrogen atoms than an alkene with the same number of carbon atoms.

23. Name the first 4 alkenes and give their formula.

Ethene  $C_2H_4$ , Propene  $C_3H_6$ , Butene  $C_4H_8$ , Pentene  $C_5H_{10}$

24. What is a displayed formula?

The drawn out formula that shows the each atom and each bond present in a molecule

25. State and explain the trend in boiling point, viscosity and volatility of alkanes.

As the number of carbon atoms increases, boiling points and viscosity increase and volatility decreases. This is because there are more intermolecular forces between the molecules which makes it harder to separate them.

26. What is cracking?

The thermal decomposition of long alkanes into shorter alkanes and alkenes.

27. Why are long hydrocarbons cracked?

There is a high demand for short chain alkanes but a low supply. There is a high supply but low demand of long chain hydrocarbons. Cracking ensures that there is a good supply of short chain alkanes. The alkenes are used to make plastics.

28. What are the conditions for catalytic cracking?

High temperatures and a catalyst of broken porous pot/Aluminium oxide.

29. How is cracking carried out in the lab?

Alkane vapours are passed over a hot catalyst made of broken porous pot or aluminium oxide. The vapours can also be mixed with steam at very high temperatures.

30. What is a monomer?

An alkene used to make a polymer.

31. What is a polymer?

A large molecule made from many monomers.

32. How are polymers formed?

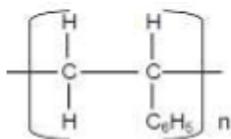
Many monomers join by breaking their double bond and forming single bonds to make a long chain.

33. What is the polymer formed from propene?

Polypropene

34. How do you draw the repeating unit of a polymer from the monomer?

Replace the double bond with a single bond, add a single bond on either end of the monomer, draw square brackets around the molecule and add an n at the bottom.



35. Why is polythene used to make plastic shopping bags?

They are strong, light and water proof. They can be reused or recycled.

36. What is the disadvantage of using plastics made from crude oil?

They are non-biodegradable (cannot be broken down by micro-organisms. They take up valuable landfill space, their production requires large amounts of energy which releases CO<sub>2</sub> gas. Crude oil is non-renewable. They contribute to litter.

37. What are smart polymers?

Polymers that have their properties changed by light, water or temperature changes

38. Give examples of smart polymers.

Hydrogels used in nappies to absorb liquids, light-sensitive plasters that stop being sticky when exposed to light, shape memory polymers used to stitch wounds loosely. When warmed the polymer tightens and closes the wound.

39. What are the problems with recycling polymers?

Recycling requires specialist facilities which are expensive to build. Workers are needed to sort the different plastics. It does not save as much energy as recycling other materials.

40. What are the disadvantages of biodegradable polymers?

Land is used to grow corn instead of food. The plastic breaks down when exposed to light which means the bag won't last as long.

41. Plastics can be burned to release energy. What are the problems associated with this disposal method?

It does not preserve crude oil reserves; CO<sub>2</sub> released which could cause global warming; might release toxic gases.