DF.a-u - Developing Fuels | DF1-11

DF.Q Exam questions from past papers

Explain why the C=O double bond is shorter than the C–O single bond (2)

Explain why the C=O double bond is shorter than the C–O single bond.

.....

..... [2]

- there are more electrons between the atoms in the double bond (1)
- giving greater attraction between the bonded atoms (1)

(iii)	there are more electrons between the atoms of the double bond/in the double bond ✓ giving greater attraction between the (bonded) nuclei/atoms or nuclei/atoms are pulled closer togethe

(e) ETBE can be manufactured from bioethanol. Both ETBE and bioethanol are called biofuels.

Explain why biofuels are regarded as a sustainable energy source, and why they are often described as 'carbon neutral'.

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..... [3]

Explain why biofuels are regarded as a sustainable energy source and why they are often describes as 'carbon neutral' (3)

comes from crops which can be re-grown/AW ✓ ants take in/absorb/use CO2 for photosynthesis/growth ✓ (roughly) balances out CO2 produced on burning ✓	*Q1(e)(i)- GCE – Chemistry B – June 2013 – F331/01* word is 'grow/growing/growth' etc in the context they can be replenished **NOT** just 'while living' core both points 2 and 3, CO2 must be mentione implied in both the answers reference to idea of balance maximum total mark **IGNORE** references to C or CO

- Comes from crops which can be regrown (1)
- Plants take in CO_2 for photosynthesis (1) which balances out roughly with CO_2 produced on burning (1)

(ii) When biodiesel burns it produces less carbon monoxide than similar fuels made from crude oil.

Explain why less carbon monoxide is produced and why this is desirable.

In your answer, you should use appropriate technical terms, spelt correctly.

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..... [3]

When biodiesel burns it produces less carbon monoxide than similar fuels made from crude oil.
Explain why less carbon monoxide is produced and why this is desirable?

(ii) (O atom in structure allows) combustion more thorough / complete therefore carbon dioxide produced (1);

QWC mark = any of combustion / combust(s) / oxidised / oxidized / oxidation

CO is toxic / poisonous / correct description of why it is toxic (ora) (1);

fuel more efficient (AW) (1);

***note**: QWC mark is **not** a separate marking point. Appropriate word has to be spelt correctly to score first mark.*

***do not allow** harmful/bad for you (too vague)*

*acid rain and greenhouse gas **con** toxic mark*

***ignore** photochemical smog*

3

Oxygen atom in structure allows more complete combustion therefore carbon dioxide produced (1) which is more fuel efficient (1) and this is desirable as CO is toxic (1)

Compare
$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ (ethanol)
$C_2H_6 + 3.5O_2 \rightarrow 2CO_2 + 3H_2O$ (ethane)

Why can't the enthalpy change for a thermal decomposition reaction be measured directly?

The enthalpy change for the thermal decomposition of sodium hydrogencarbonate, ΔH_1, is difficult to determine directly by experiment.

Instead the enthalpy change for the reaction is determined indirectly using Hess' law.

The enthalpy changes ΔH_2 and ΔH_3 are determined separately.

$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_2 **Equation 4.2**

$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_3 **Equation 4.3**

(a) Suggest why it is difficult to measure ΔH_1 directly.

.....

..... [1]

As thermal decomposition requires heat

Thermal decomposition requires heat ✓	1	3.4	**ALLOW** other reactions may occur

(f) Why can bond enthalpies **not** be used to estimate ΔH_1?

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$ ΔH_1

.....

..... [1]

Why can bond enthalpies not be used to estimate ΔH_1? (1)

$2NaHCO_3$ (s) -> Na_2CO_3 (s) + CO_2 (g) + H_2O (l)

$NaHCO_3$ (and Na_2CO_3) ionic so not all bonds are covalent (AW) ✓	1

$NaHCO_3$ and Na_2CO_3 are ionic so not all bonds are covalent (1)

Techniques have now been found to convert GVL into a fuel that can be used on its own, without blending.

One component of the fuel is hydrocarbon **A** with the following skeletal formula.

hydrocarbon A

The energy density of a fuel is the amount of energy, in kJ, released when 1.0 kg of the fuel is burned.

The enthalpy change of combustion of hydrocarbon **A** is $-5300\,kJ\,mol^{-1}$.

Calculate its energy density.

Give your answer to **two** significant figures.

energy density = ... kJ per kg **[3]**

Calculate its energy density?

M_r of $C_8H_{16} = 112$ ✓ Moles in one kg = 1000/112 = 8.93 kJ per kg = 8.93 x 5300 = 47329 ✓ (depending on rounding) two sf's (47000/4.7 x 10^4) ✓ **correct answer is 3 marks**	3	ecf on wrong formula in (i) ecf on wrong M_r above **ALLOW** sig fig mark from any correct calculati **NB a different approach** to solving the proble energy per gram = 5300/112 then kJ per kg = 1000 **IGNORE** sign of answer

- Mr of C_8H_{16} = 112
- Moles in one kg = 1000/112 = 8.93
- KJ per kg = 8.93 x 5300 = 47329
- = 47000 KJ per kg

(iii) In the experiment the water in the beaker was heated for 5 minutes. The student thought that the experiment could be improved by heating the water for 10 minutes.

Explain whether the accuracy in the student's calculated value for $\Delta_c H$ may or may **not** be improved by heating for longer.

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..... [2]

Explain whether the accuracy in the student's calculated value for $\Delta_c H$ may or may not be improved by heating for longer.?

- Less accurate due to greater heat losses
- More accurate due to smaller % uncertainty in temperature change or mass of fuel burnt

Less accurate due to greater heat losses ✓

More accurate due to smaller % uncertainty in temperature change **OR** mass of fuel burnt ✓

ALLOW less accurate due to evaporation of water

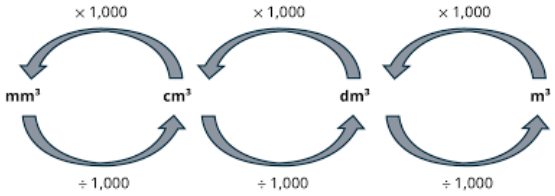
ALLOW error for uncertainty

ALLOW for both marks
May not change as
increase in temperature change
OR increase in mass of fuel burned would decrease % uncertainty
BUT
may be outweighed by increased heat loss to surroundings

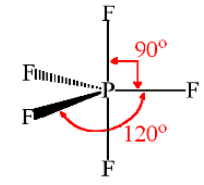
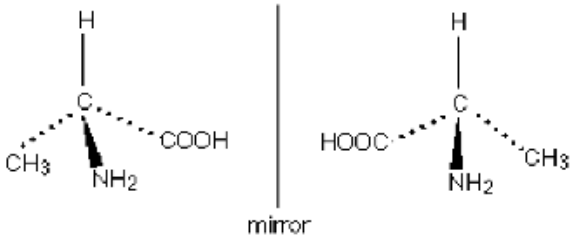
7 A sample of gas, volume V, has its temperature raised from 0 °C to 20 °C. The pressure remains constant. What is the new volume? **A** 0.005 V **B** 0.93 V **C** 1.07 V **D** 20 V Your answer ☐ [1] A sample of gas, volume V, has its temperature raised from 0°C to 20°C. The pressure remains constant. What is the new volume? And method how?	C ● v=nRT/p ● 1x8.314x273/1 = 2269 ● 1x8.314x293/1 = 2436 ● 2436/2269= 1.07
14 Why are many bond enthalpies described as *averages*? **A** They are averaged out over many molecules with different kinetic energies. **B** They are averaged out over different compounds containing the same bond. **C** They are the averages of the bond in liquid and gaseous compounds. **D** They are average values from different data books. Your answer ☐ [1] 23 Cyanogen, N≡C–C≡N, is a gas which gives a very hot flame when it burns. $N{\equiv}C{-}C{\equiv}N(g) + O_2(g) \rightarrow 2CO(g) + N_2(g)$ $\Delta_r H = -529\,kJ\,mol^{-1}$ **Equation 23.1** **Table 23.1** gives some bond enthalpy data. **Table 23.1** Bond / Enthalpy / kJ mol⁻¹ | Bond / Enthalpy / kJ mol⁻¹ C–C (average) +347 | O=O +498 C≡O (in CO) +1077 | C=O (in CO_2) +805 N≡N +945 **(a)** The bond enthalpy for C–C in **Table 23.1** is described as an **average** bond enthalpy. Explain the meaning of average in this context. .... [1] Why are many bond enthalpies describes as averages and Explain the meaning of **average** in this context	14 B 1 23 (a) based on several/many compounds/molecules (AW) ✓ 1 ● B and based on several molecules *Don't say many/several compounds as 2023 MS said ignore*

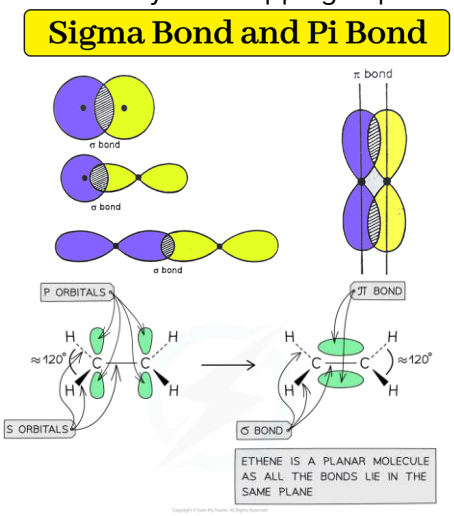
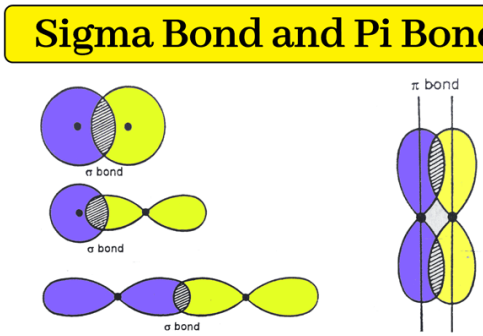
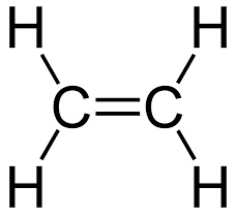
DF.a - Formulae, equations and amount of substance | DF2 | DF8 |

What is the equation linking mol (n), volume of gas (dm^3), and molar gas volume (24d m^3)?	$$n = \frac{\text{volume of gas}}{\text{molar gas volume}}$$ *This is used for anything under standard conditions.* $$amount\ of\ gas\ (mol) = \frac{volume\ of\ gas\ (dm^3)}{24.0\ (dm^3\ mol^{-1})}$$
What is 25cm3 equal to?	25g and 25ml

What is the conversion framework between the 4 cubic units?	 Remember: **mm**m m**cd**onalds **m**ilkshake
What is the ideal gas equal and what is each unit measured in at RTP where possible ?	$$pV = nRT$$ Where p is pressure (Pa), V is volume (m^3), n is moles (mol), R is the gas constant, T is temperature (K). p = 101kPa V = $24x10^{-3}m^3$ n = mol R = 8.314 J K^{-1} T = 298K *Don't use pV=nRT for RTP use molar gas volume equation this was just an example*
What is 1 atm pressure in pascals?	101kPa or 101000Pa

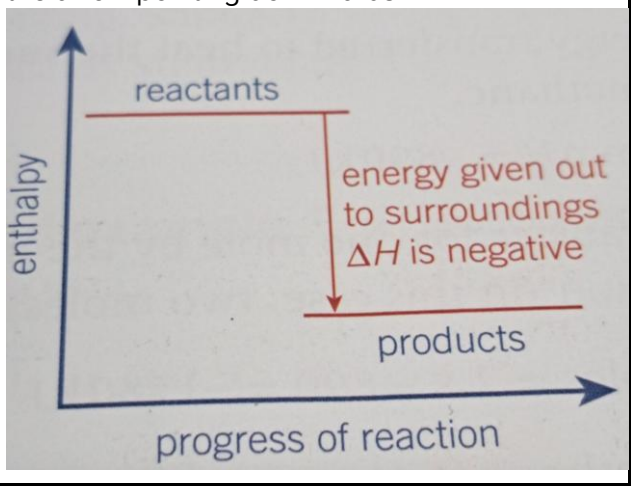
DF.b-c - Bonding and structure | DF6 | DF9 |

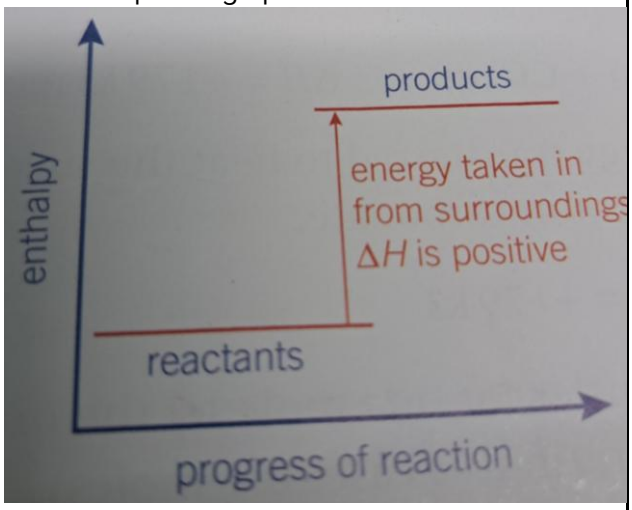
What are the 3 wedges for the shape of molecules?  *Trigonal bipyramidal.*  There are enantiomers / optical isomers.	1. Solid line is a bond on the plane of the paper 2. Solid wedge/triangle is a bond that comes out of the plane of paper 3. Dotted line is a bond going into the plane of the paper

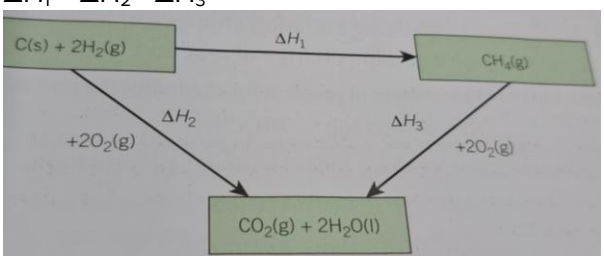
What is a **π** bond (with diagram e.g., ethene)	The sideways overlapping of p-orbitals  Draw the full reaction with the arrows
What is the σ bond?	The overlap of orbitals directly between atoms  *The overlap of s orbital and s orbitals or s orbitals and p orbitals*
How to calculate how many **π** or σ bonds a compound has? And how many does Ethene have? 	• Pi bonds is the number of double or triple bonds • Sigma bonds is the number of single, double and triple bonds • Ethane has 1 pi bond and 5 sigma bonds

DF.d-g - Energetics | DF1 | DF2 | DF4 |

What is the conversion factor between Kelvin and Celsius?	Add 273 to C to get K

What is an exothermic reaction?	A reaction that gives out energy and heat the surroundings
What is an endothermic reaction?	A reaction that takes in energy and cools the surroundings
Breaking bonds is... because... (remember Bending)	● Endothermic ● Energy is put into the system ● Remember Bendo *Atoms becomes less stable as they have no bonds and lots of energy*
Making bonds is... because.. (remember Mexico)	● Exothermic ● Energy is released to the surroundings ● Remember Mexo *Despite the little energy needed to make a bond, the molecules becomes more stable when bonded and thus releases energy*
Draw and label the energy profile diagram for an exothermic reaction with no activation energy	● ΔH is negative as energy is exiting the system to surroundings and thus exothermic ● Taking up to be the positive direction we have the arrow pointing downwards 

Draw and label the energy profile diagram for an endothermic reaction with no activation energy	• ΔH is positive as energy is entering the system from the surroundings and thus endothermic • Taking up to be the positive direction we have the arrow pointing upwards 
How is energy transferred calculated or SHC)?	[q=mcΔT] Energy transferred (J) = **mass** x specific heat capacity x temperature change (Mass of the substance that changes temperature e.g. water in combustion not the fuel) *Also for some questions you are given the volume of a substance like 5cm^3 and 0.1moldm^{-3} for an aqueous substance DONT FORGET that 5cm^3 = 5g do not convert into moles then times by RFM to get mass*
How is enthalpy change calculated?	+-ΔH = q/n (Moles of the limiting reactant) *The plus or minus depend on whether the reaction was exothermic or endothermic* *CHECK FORM THE TEMPERATURE CHANGE IF THE REACTION IS EXOTHERMIC OR ENDOTHERMIC unless stated in the question*
What are the general standard conditions that allows us to compare enthalpy changes?	• A specific temperature normally chosen as 298K (25℃) • A standard pressure of 1 atm (equal to 101kpa or 1.01x10^5 Nm^{-2}) • A standard concentration of 1 moldm^{-3} for solutions
Define Standard states?	The physical state of a substance under standard conditions. This may be a pure solid liquid or gas

Define (Standard) enthalpy change for a reaction $\Delta_rH^{\ominus}$?	The enthalpy change when molar quantities of reactants as stated in the equation react together under standard conditions
Define (Standard) enthalpy change of combustion $\Delta_C H^{\ominus}_{298}$?	The enthalpy change that occurs when one mole of a substance is burnt completely in oxygen under standard conditions in standard states
Define the (standard) enthalpy change of formation? $\Delta_f H^{\ominus}_{298}$?	The enthalpy change when one mole of a compound is formed from its elements under standard conditions in standard states
Define the (standard) enthalpy change of neutralisation $\Delta_{neut} H^{\ominus}_{298}$?	The enthalpy change when one mole of hydrogen ions react with one mole of hydroxide ions to form one mole of water under standard conditions and in solutions containing 1 mol dm-3
Describe limitations with techniques for measuring enthalpy changes of an Exothermic reaction through calorimetry?	● Heat loss to the surroundings ● Heat loss to the calorimeter ● Non standard conditions ● Specific heat capacity of the container is not included
Describe limitations with techniques for measuring enthalpy changes of an Endothermic reaction through calorimetry?	● Heat gained from the surroundings ● Heat gained from the colorimeter ● Non standard conditions ● Specific heat capacity of the container is not included
What are the limitations and reasons why our calculated answer for the enthalpy change using calorimetry with a spirit burner and a calorimeter is “too low”?	● Heat loss to surroundings ● Heat loss to the calorimeter ● Non standard conditions ● Evapouration of the fuel ● Evapouration of the water ● Incomplete combustion
What does Hess’ law state?	The enthalpy change for any reaction is independent of the route taken
Define Specific Heat Capacity?	The amount of energy needed to raise the temperature of 1g of a substance by 1K
What is the equation to calculate $\Delta_f H$, $\Delta_r H$ and $\Delta_C H$ using Hess’s Law energy cycles and draw the hess cycle to calculate the enthalpy change of formation of methane using the enthalpy change of combustion with state symbols and boxes?	$\Delta H_1 = \Delta H_2 - \Delta H_3$ 

What is the enthalpy change of formation of any element $\Delta_f H$?	Zero
Why is a polystyrene cup used in calorimetry compared to glass?	Better insulator
Why do we extrapolate graphs in calorimetry or in any enthalpy change calculation where a graph is drawn?	To get correct values for cooling and heat loss
What is the average bond enthalpy of oxygen in combustion enthalpy cycles?	Zero because you can't burn oxygen in oxygen
Define average bond enthalpies?	The average quantity of energy needed to break a particular bond
What is ΔH_r equal to? (using bond enthalpies)?	$\Delta H^\circ_r = \Sigma \Delta H$ bonds broken − $\Sigma \Delta H$ bonds made
Why is the data book value for bond enthalpies different from calculated values?	• Average bond enthalpies • Non standard states (depending on the question bond enthalpies are supposed to be in a gaseous state) *Some allow not stirring, incomplete reaction, evaporation of water but not incomplete combustion or all reactants reacted*

What are methods of improving the accuracy of an enthalpy change of combustion reaction (depending on the question and the method the student has used? State 4

(e)* The student uses the following procedure to obtain the measurements in **part (d)**.

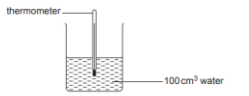


Fig. 4.1

Procedure:

1 The mass of a spirit burner containing methanol is measured and recorded.

2 100 cm^3 of water is measured into a 250 cm^3 glass beaker using the graduations on the beaker.

3 The temperature of the water is measured and recorded.

4 The apparatus is set up as shown in **Fig. 4.1**, with the beaker being held in position using a clamp, boss and stand (not shown).

5 The wick of the spirit burner is ignited.

6 When the temperature of the water in the beaker has risen by about 30 °C, the flame on the spirit burner is blown out.

7 After the water is emptied out of the beaker and the apparatus has been put away, the mass of the spirit burner is measured and recorded again.

The student wants to improve the accuracy of the calculated enthalpy change of combustion by changing the method.

Suggest and explain possible improvements to the procedure on page 18.

- Use a Bomb calorimeter (Removes error in heat loss, better conductivity)
- Use a copper can (better thermal conductor/ lower SHC)
- Draft shield (less heat loss to the surroundings)
- Fit the spirit burner with a cap (reduced loss of fuel **before** burning)
- Digital thermometer (better accuracy idk)
- Put a lid on the calorimeter (to reduce heat loss to the surroundings)
- Measure water using measuring cylinder or volumetric pipette (less uncertainty/ more accurate than a beaker)
- Stir water throughout heating (ensures even distribution of heat)
- Decrease the distance between the flame and the bottom of can/beaker (less heat lost to the surroundings)
- Lag (sides of) calorimeter (less heat loss to the surroundings)
- Oxygen enriched atmosphere (more complete combustion)

- weight out or measure the (100 cm^3) water using a (100 cm^3) measuring cylinder or pipette
- *the balance/measuring cylinder has less uncertainty/more accurate than the beaker*
- Place a lid on the calorimeter
- *To reduce evaporation of the water/heat loss*
- pour water into a copper can
- *copper better thermal conductor than glass/lower specific heat capacity*
- fit the spirit burner with a cap
- *reduces loss of methanol before burning*
- arrange for less distance between top of flame and bottom of can/beaker (or top of flame touches bottom of can)
- *less heat transferred/'lost' to surroundings*
- arrange a draught shield around apparatus
- *less heat transferred/'lost' to surroundings*
- stir water throughout heating
- *ensures even distribution of heat*
- replace cap on burner and find mass after burning
- *reduces loss of methanol after combustion*
- record the highest temperature reached by the water
- *heat continues transfer from can to water*

- Use of a Bomb Calorimeter
- *Removes errors in heat loss, better conductivity, greater heat transfer, more even distribution*

Why can't the enthalpy change for a thermal decomposition reaction be measured directly?

The enthalpy change for the thermal decomposition of sodium hydrogencarbonate, ΔH_1, is difficult to determine directly by experiment.

Instead the enthalpy change for the reaction is determined indirectly using Hess' law.

The enthalpy changes ΔH_2 and ΔH_3 are determined separately.

$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_2 **Equation 4.2**

$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$ ΔH_3 **Equation 4.3**

(a) Suggest why it is difficult to measure ΔH_1 directly.

.....

..... **[1]**

As thermal decomposition requires heat

Thermal decomposition requires heat ✓	1	3.4	**ALLOW** other reactions may occur

(f) Why can bond enthalpies **not** be used to estimate ΔH_1?

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$ ΔH_1

.....

..... **[1]**

Why can bond enthalpies not be used to estimate ΔH_1? (1)

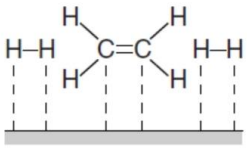
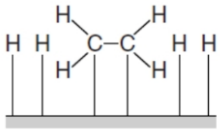
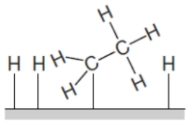
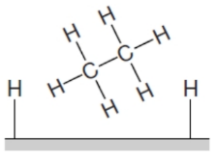
$NaHCO_3$ (and Na_2CO_3) ionic so not all bonds are covalent (AW) ✓	

$NaHCO_3$ and Na_2CO_3 are ionic so not all bonds are covalent (1)

$2NaHCO_3$ (s) -> Na_2CO_3 (s) + CO_2 (g) + H_2O (l)	
Why can ‘enthalpy change of formation’ not be measured directly?	Many different compounds can form from the same constituent elements

DF.h-j - Kinetics | DF5 |

Define Catalyst?	A substance which speeds up a reaction and can be recovered chemically unchanged at the end
Define Catalysis	The process of speeding up a chemical reaction using a catalyst
Define Catalyst Poison	A substance that **stops** a catalyst functioning properly
Define Heterogeneous Catalyst and its benefits and drawbacks?	The catalyst and the reactants are in different physical states ● Can be easily separated ● Reactions only take place on the catalyst’s surface
Define Homogeneous Catalyst and its benefits and drawbacks?	The catalyst and the reactants are in the same physical states ● It means more molecules can react ● It means separating molecules at the end harder
Define Cracking?	Breaking up larger long chain molecules into smaller more useful molecules

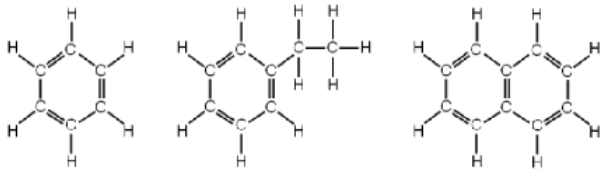
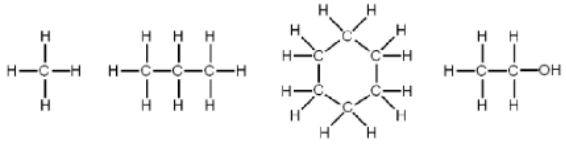
Explain the simple model of the function of a heterogeneous catalyst? (4)	1. Reactants get adsorbed onto the catalyst surface  B 2. Bonds weaken and break in the reactants  D 3. New bonds form products  A 4. Products diffuse off the surface of the catalyst (desorbed)  C
Explain how a catalyst increases the rate of a chemical reaction & what do they do? (1)?	It provides an alternative reaction pathway of lower activation energy without being used up
How does a catalyst poison work?	It is more readily adsorbed than the reactants and so reduces the surface area of catalyst and so reactants cannot bond to its surface

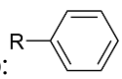
DF.k - Inorganic chemistry and the periodic table | DF10 | DF11 |

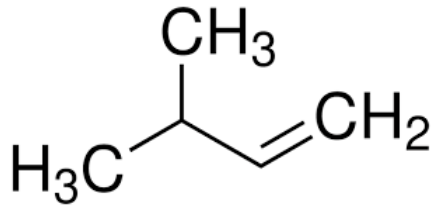
What are the causes and effects of Carbon particulates (Carbon soot)?	● Burning fuels, incomplete combustion and therefore ● respiratory problems, global dimming
What are the causes and effect of C_xH_y?	● Unburnt fuel from petrol engines, plants and therefore ● photochemical smog
What are the causes and effects of CO?	● Incomplete combustion and therefore ● toxic/poisonous (causing respiratory problems) ● photochemical smog

What are the cause and effects of CO_2?	● Complete combustion and therefore ● greenhouse gas causing global climate change
What are the cause and effects of NO_x?	● N_2 from the air reacts with oxygen from the air in high temperatures and therefore ● Photochemical smog, acid rain
What is the way of reducing NO_x that is produced	● Using a catalytic converter to produce nitrogen $2NO\ (g) \rightarrow N_2\ (g) + O_2\ (g)$
What is the balanced equation for catalysing CO and NO in a catalytic converter**?**	$2CO + 2NO \rightarrow N_2 + 2CO_2$ *NO_2 is not a product*
What are the causes and effect of SO_x?	● Burning of fuels containing sulfur impurities (and volcanoes) therefore ● Acid rain
What is the way of reducing SO_2 that is produced	● By using fuels with low concentration of sulfur impurities ● In a power plant by spraying an alkali to neutralise the sulphur dioxide

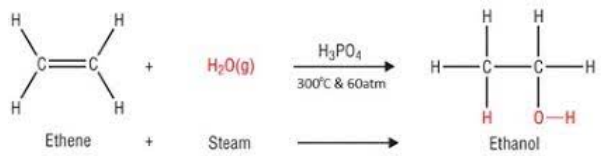
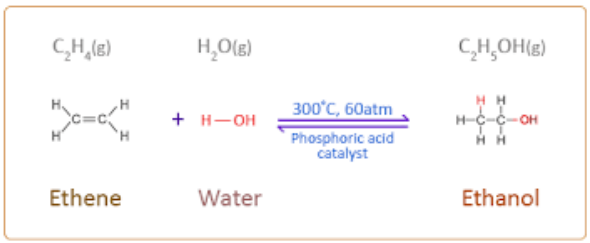
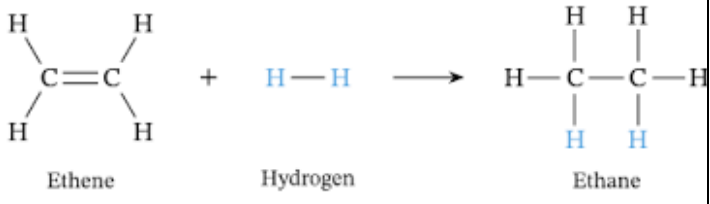
DF.l-m - Organic functional groups | DF3 | DF5 | DF6 |

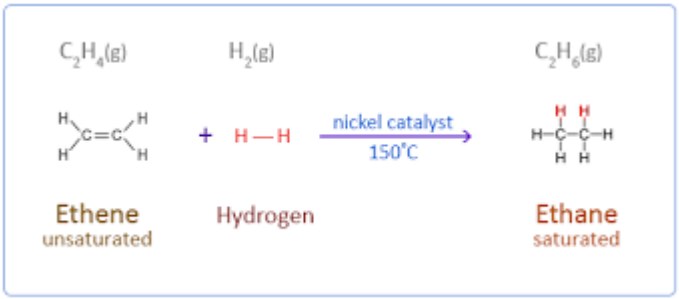
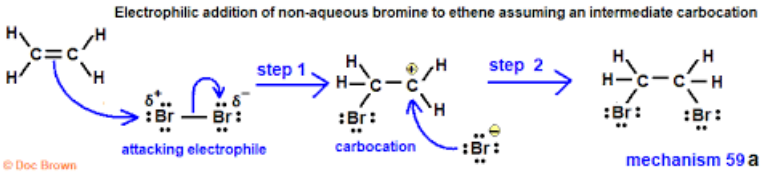
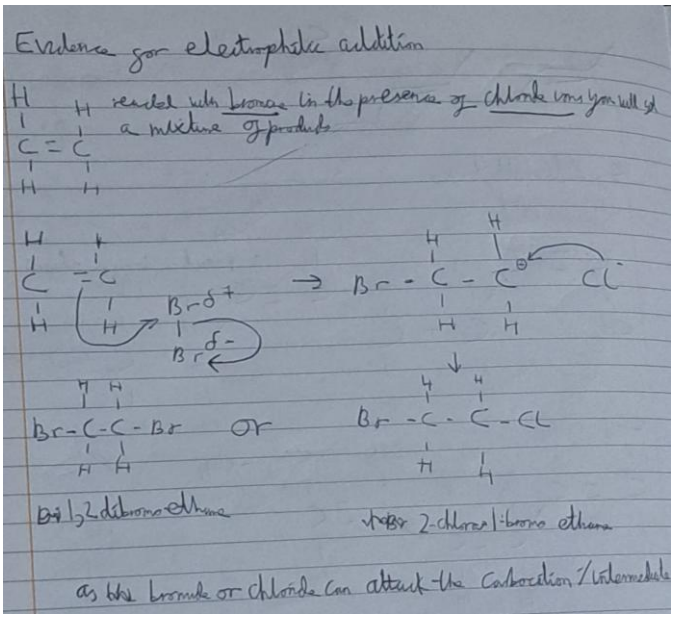
What is the general formula of the alkenes?	C_nH_{2n}
What is the general formula of the alkanes?	C_nH_{2n+2}
What is the general formula of the alcohols?	$C_nH_{2n+1}OH$
Define arenes/aromatic compounds?	Compounds that contain one more benzene rings  Benzene Ethylbenzene Naphthalene
Define aliphatic compounds?	Compounds that do not contain any benzene rings  *Cyclohexane is more specifically alicyclic yet also aliphatic.*
Define functional group?	Modifiers that are responsible for the characteristic chemical reactions of molecules
Define Homologous series?	A family of compounds with the same functional group

	yet each successive member differs in the addition of a -CH_2- group
Define Hydrocarbon?	A compound consisting of only hydrogen and carbon atoms
Define Saturated and unsaturated?	● Saturated means only single carbon-carbon bond ● Unsaturated means a double or triple carbon-carbon bonds (e.g., C=C and C≡C Remember, s in saturated for single bond
Test for unsaturated compounds?	Add bromine water which turns the solution from orange to colourless. *Check to see whether bromine water is being added to a compound or vice versa as the colour change may be switched its not always orange to colourless - Mr Harbage Also check to see if its bromine water (orange) or bromine liquid (red) easy mistake*
Difference between displayed and skeletal formulae?	● Displayed - every bond is drawn ● Skeletal - carbon to hydrogen and carbon to carbon bonds arent drawn Every bond means -OH should be drawn as -O-H
What are the first 5 Alkyl groups?	Methyl, Ethyl, Propyl, Butyl, Pentyl
What are the first 3 prefixes used during naming branched alkanes?	Di- tri- tetra-
Functional group,prefix, and suffix of an alcohol?	● Functional group: -OH ● Prefix: hydroxy- (dihydroxy-) ● Suffix: -ol (-diol) [more common]
Functional group and prefixes of haloalkanes?	● Functional group: C-X (e.g. C-Cl) ● Prefix: fluoro-, chloro-, bromo-, iodo-  *E,g., 1-chloropropane*
Functional group, prefix and suffix of arenes?	● Functional group:  ● Prefix: phenyl- ● Suffix: -benzene

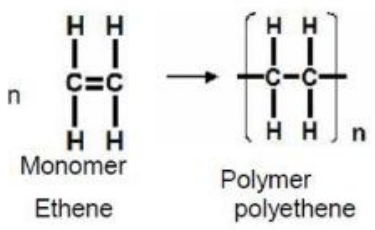
What takes precedence when naming with branched chains? Name the e.g. bond 	• Functional groups • E.g., 3-methylbut-1-ene is right, 2-methylbut-3-ene is wrong

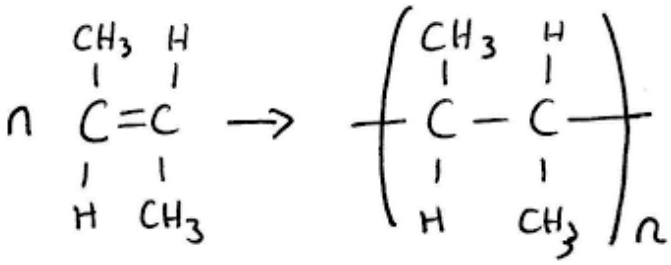
DF.n-o - Organic reactions | DF6 | DF10 |

What is the hydration of alkenes and its reagents, catalyst and conditions?	• Forming alcohols from alkenes • Conditions: steam, phosphoric acid catalyst, around 300°C and 60 atm • Or concentrated sulfuric acid with water E.g, $C_2H_4 + H_2O \rightarrow C_2H_5OH$
Draw the hydration of ethene and water (steam) and its products using its full structural formula?	 
What is hydrogenation of alkenes and its reagents, catalyst and conditions?	• Forming alkanes from alkenes • Regent & conditions: Nickel catalyst and Hydrogen at 150°C and 5 atm • Or Regent & conditions: Platinum catalyst at RTP, 298K, 1 atm E.g., $C_2H_4 + H_2 \rightarrow C_2H_6$
Draw the hydrogenation of ethene and hydrogen and its products using its full structural formula?	

	
What is the reaction of an alkene with a hydrogen halide and its conditions	• Forming haloalkanes from alkenes • Conditions: RTP
Draw the halogenation (electrophilic addition reaction mechanism) between bromine and ethene? And the name of the compound form?	 1,2,di-bromoethane or 1,1,di-bromoethane
Draw the electrophilic addition reaction mechanism of ethene in bromine with the presence of chloride ions and draw and name the two possible products?	

DF.p - Polymers | DF7 |

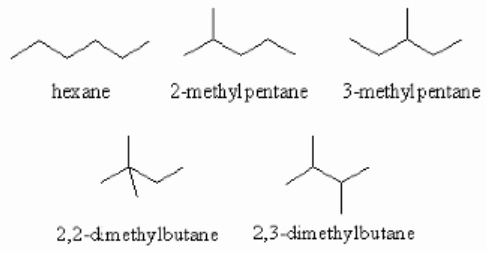
Draw the polymerisation of monomers into a polymer? (e.g. but-1ene)	 *The bracket with the ethane inside is a repeat unit.*

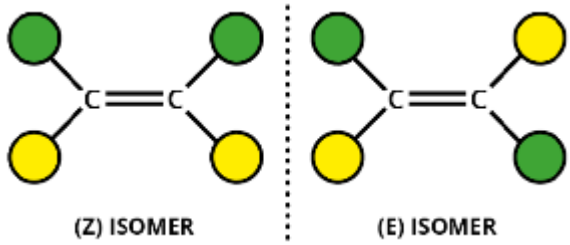
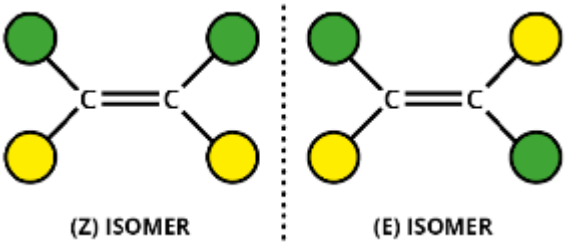
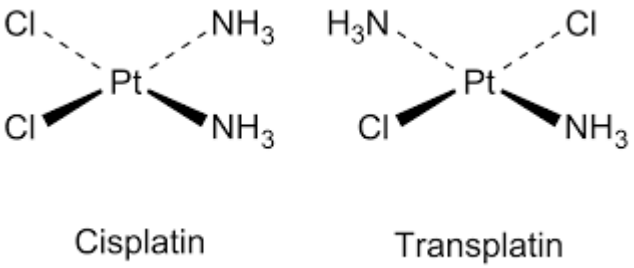
	
What conditions are required for polymerisation?	• High temperature • High pressure • A catalyst

DF.q - Organic Mechanics | DF6 |

Where must curly arrows start?	At the centre of a bond or at a lone pair
Define addition reaction?	A reaction where two or more molecules react to form a single larger molecule
Define electrophile?	A **positive ion** or a molecule with a partial positive charge that will be attracted to a negatively charged region and react by accepting a **bonding pair of electrons** to form a **covalent bond** *Think of 'phile' as meaning loving. It loves electrons*
Define carbocation (intermediate)?	An ion with a positively-charged carbon atom

DF.r-t - Isomerism | DF3 | DF9 |

Define structural isomers?	Same molecular formula but a different structural formula E.g.,  *This has the subsets of chain isomers, positional isomers, and functional group isomers.*
Define stereoisomers?	Same structural formula but different spatial arrangement of atoms

What is required for E-Z stereoisomerism to arise?	1. A double C=C (which provides restricted rotation) 2. Two different groups coming of each carbon atom of the carbon - carbon bond 
How to remember which E/Z stereoisomer is E or Z?	Z is the Zame Zide and E is the Epposite 
How to remember which cis/trans stereoisomer is cis or trans?	Cis is the ciame cide and trans is the opposite (think transgender) 
Which important bonds are freely rotating in organic chemistry?	Single C-C and C-H bonds

DF.u - Sustainability | DF11 |

What are the advantages of using hydrogen as a fuel? (state 3)	● Renewable/sustainable ● Can be stored and sent down pipelines ● Can be used in internal combustion engines ● Doesnt produce CO_2, CO or hydrocarbons ● More energy dense than petrol and so releases more energy per kg than petrol ● Produced from fermentation [from MCQ A Level paper 1 2025]
What are the disadvantages of using hydrogen as a fuel? (state 3)	● Production from water depends on the use of electricity from fossil fuels ● Oxides of nitrogen are still produced at high temperatures ● Difficult to store as it requires a highly pressurised tank ● More danger of explosion ● Expensive
What are the advantages of using Biofuels as a fuel (state 3)	● Renewable/sustainable ● Biodegradable ● Avoids wasting/using up fossil fuels ● Less CO is produced and reduced greenhouse gases through oxygen in its structure ● Carbon neutral (although not allowed on some mark schemes due to transportation) you may say lower carbon footprint sometimes ● Produced from fermentation [from MCQ A level paper 1 2025] *Refer to the flashcard at the very top for debate ability of carbon neutrality* **Biofuels** 1) Biofuels are fuels made from **living matter** over a **short period** of time — • **bioethanol** is ethanol made by the **fermentation** of **sugar** from crops such as maize, • **biodiesel** is made by **refining** renewable **fats** and **oils** such as vegetable oil, • **biogas** is produced by the breakdown of **organic waste matter**. 2) These fuels do produce CO_2 when they're burnt, but it's CO_2 that the plants **absorbed** while growing, so **biofuels** are usually still classed as **carbon neutral**. But CO_2 is still given out while refining and transporting the fuel, as well as making the fertilisers and powering agricultural machinery used to grow and harvest the crops. 3) Biodiesel and biogas can also be made from waste that would otherwise go to **landfill**. 
What are the disadvantages of using Biofuels e.g Ethanol as a fuel (state 2) **32** Ethanol is sometimes used as a biofuel to replace petrol in car engines. However it has several disadvantages. **(a)** Give **two** disadvantages of ethanol as a replacement fuel for petrol. .... [2]	● Expensive to convert existing petrol car engines to take fuels with a high concentration of ethanol ● Land that could have been used to grow food is being used to make fuel this could cause food shortages in countries ● Disposal of fermentation waste (environmental problem it causes) *Allow ethanol has a lower enthalpy change of combustion than petrol*

	Two marking points from the following: • Large amounts of arable land are required to produce the crops required to obtain large amounts ethanol • (Environmental problem caused by) disposal of fermentation waste • Current car engines need to be modified to use high concentrations of ethanol ✓ ✓	**2**	**ALLOW** ethanol has a lower enthalpy change of combustion than petrol **IGNORE** better for the environment

4) But one problem with switching from fossil fuels to biofuels in transport is that **petrol car engines** would have to be **modified** to use fuels with high ethanol concentrations.

5) Also, the land used to grow crops for fuel can't be used to grow **food** — this could be a serious problem... **Developed** countries (like the UK) will create a huge demand as they try to find fossil fuel alternatives. Poorer **developing** countries (in South America, say) could use this as a way of **earning money**, and convert farming land to produce 'crops for fuels'. This may mean they won't grow enough food to eat.