Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) (i) fractional distillation	**1**	
(ii) contains only single bonds	**1**	You could also say that the C is always bonded to 4 other atoms – but don't say 4 H atoms because that would only give methane.
(b) $C_{10}H_{22} + 5½O_2 \rightarrow 10C + 11H_2O$	**1**	You can have double this value in all the substances in the equations if you don't like working with halves.
(c) (i) $½N_2 + ½O_2 \rightarrow NO$	**1**	
(ii) platinum or palladium or rhodium	**1**	
(iii) $2CO + 2NO \rightarrow 2CO_2 + N_2$	**1**	Equations are worth 1 mark and must be completely correct, i.e. the formulae and the balancing.
or $2NO \rightarrow N_2 + O_2$		
or $C + 2NO \rightarrow CO_2 + N_2$		
or $C_8H_{18} + 25NO \rightarrow 8CO_2 + 12½N_2 + 9H_2O$	**1**	
2 (a) (i) $C_8H_{18} + 8½O_2 \rightarrow 8CO + 9H_2O$	**1**	
(ii) *condition*: spark or high *T* or *T* in range 2500–4000 °C	**1**	
equation: $N_2 + O_2 \rightarrow 2NO$	**1**	
(b) (i) platinum or rhodium or palladium	**1**	
(ii) $2CO + 2NO \rightarrow N_2 + 2CO_2$	**1**	
(c) *reason for SO_2 in exhaust gases*: fuels contain sulfur impurities which burn to give SO_2	**1**	
environmental effect of SO_2: acid rain or a specific effect explained, e.g. kills trees since the soil gets too acid	**1**	SO_2 has no effect on the greenhouse effect or the ozone layer, so don't put either of them as your answers.
3 (a) (i) fractional distillation	**1**	
(ii) C_9H_{20} only	**1**	
(iii) $C_{11}H_{24} + 17O_2 \rightarrow 11CO_2 + 12H_2O$	**1**	When you balance combustion equations do the C first then the H and do the O last of all.
(iv) $C_{11}H_{24} + 6O_2 \rightarrow 11C + 12H_2O$	**1**	
(b) (i) $C_{10}H_{22} \rightarrow C_3H_6 + C_7H_{16}$	**1**	
4 (a) (i) compounds / alkanes with similar boiling points	**1**	You must talk about 'similar' rather than the 'same'.
(ii) molecules have different boiling points *or* different chain lengths *or* different M_r	**1**	
(iii) the column has a higher temperature at the base *or* the column has a lower temperature at the top	**1**	
(b) $C_8H_{18} + 8½O_2 \rightarrow 8CO + 9H_2O$	**1**	
(c) cracking produces small molecules of alkenes and motor fuels, e.g. petrol	**1**	You could also say that cracking makes more useful products.
(d) (i) carbocation	**1**	
(ii) zeolite *or* aluminosilicate *or* $A1_2O_3$	**1**	
(e) (i) free radical	**1**	
homolytic fission or the C–C / C–H bonds break	**1**	
(ii) alkenes	**1**	The alkenes are small-chain alkenes.

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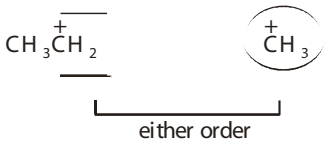
5 (a) (i) a compound consists of hydrogen and carbon only	**1**	
(ii) release heat energy when burned	**1**	Don't say burns exothermically.
(iii) $C_4H_{10} + 6½O_2 \rightarrow 4CO_2 + 5H_2O$	**1**	You can double all of this equation to get rid of the halves if you want to.
(iv) $C_4H_{10} + 4½O_2 \rightarrow 4CO + 5H_2O$	**1**	You can double all of this equation to get rid of the halves if you want to.
(v) limited supply of air or oxygen	**1**	Don't say no oxygen.
(b) *structure 2* *structure 3* 	**2**	1 mark for each structure.
(c) (i) $CH_3CH_3 \rightarrow CH_2CH_2 + H_2$	**1**	
(ii) Al_2O_3 *or* zeolite *or* aluminosilicate	**1**	
(iii) more useful products implied	**1**	
6 (a) (i) a molecule composed of hydrogen and carbon only	**1**	
(ii) only single bonds	**1**	
(b) (i) $C_{10}H_{22}$ only	**1**	Remember the general formula of the alkanes C_nH_{2n+2}. This is not $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$
(ii) $C_{14}H_{30} \rightarrow 2C_2H_4 + C_3H_6 + C_7H_{16}$ *or* $C_{14}H_{30} \rightarrow 4C_2H_4 + 2C_3H_6 + H_4$		
alkene formula	**1**	
equation balanced	**1**	
(iii) homolytic fission	**1**	
7 (a) crude oil is heated to vaporise it	**3 (max.)**	There are 4 available marking points and you have to get at least 3, since the mark scheme says 3 marks.
vapour passed into fractionating tower / column		
top of tower cooler than bottom		
fractions separated by boiling points		
(b) (i) identify shortfall in supply, e.g. petrol	**1**	
cracking produces more of the more useful products	**1**	
(ii) motor fuels	**1**	
aromatic hydrocarbons	**1**	
(c) zeolite *or* aluminosilicate	**1**	.
carbocation mechanism or heterolytic fission	**1**	
high temperature *or* about 450 °C	**1**	Don't just say warm
slight pressure, e.g. between 1 atm and 10 atm	**1**	This is not high pressure.

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8 (a) type of mechanism = free radical *or* homolytic fission	**1**	
$C_{21}H_{44} \rightarrow 3C_2H_4 + 2C_3H_6 + C_9H_{20}$		
correct alkenes	**1**	
equation balanced	**1**	
(b) (i) sulfur impurities burn to form SO_2	**1**	This can be given as an equation: e.g. $S + O_2 \rightarrow SO_2$ *or* $H_2S + 1½O_2 \rightarrow SO_2 + H_2O$
leading to acid rain *or* toxic product *or* respiratory problems	**1**	
(ii) NO is formed by reaction between N_2 and O_2 from the air	**1**	This can be given as an equation: $N_2 + O_2 \rightarrow 2NO$
high combustion temperature or spark in engine	**1**	
provides sufficient heat energy to break N≡N	**1**	
(iii) need to remove NO as forms acid rain *or* toxic product *or* causes respiratory problems	**1**	
$2NO + O_2 \rightarrow 2NO_2$	**1**	
need to remove CO as it is poisonous	**1**	
use a catalytic converter	**1**	
uses Pt / Rh / Pd / Ir as catalyst in it	**1**	Don't write a list. If one is right and one is wrong you lose the mark.
forms $N_2 + CO_2$	**1**	
$2NO + 2CO \rightarrow N_2 + 2CO_2$	**1**	If you write a correct equation you are also saying what the products are, so a correct equation is worth the last 2 marks.