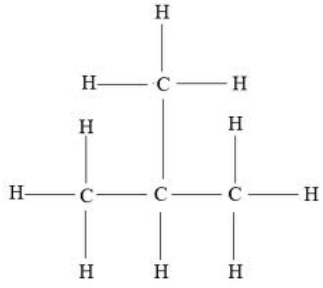
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 1 (a) (i) | (saturated) – <u>all</u> (carbon to carbon) bonds are single<br>/ no (carbon to carbon) double bonds | accept no (carbon to carbon) multiple bonds<br>ignore any references to hydrogen | 1 |
| (ii) | **M1 -** (compounds/substances/molecules) containing hydrogen and carbon (atoms/elements) | reject atoms/elements/ions/mixture in place of compounds<br>reject compounds/substances/molecules in place of atoms/elements | 1 |
| | **M2** - only | accept other terms with same meaning, e.g. solely, exclusively, just<br><br>**M2** DEP on mention of hydrogen and carbon / C and H and no other element | 1 |
| (iii) | **C** ($C_5H_{12}$) | | 1 |
| (b) (i) | $C_8H_{18} + 12.5O_2 \rightarrow 8CO_2 + 9H_2O$<br><br>**M1** – all formulae correct<br>**M2** – balanced using correct formulae | <br><br><br>accept multiples | 2 |
| (ii) | carbon monoxide | If both name and formula given, mark name only<br>accept correct formula | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 1 (c) (i) | (provides an alternative pathway of) lower activation energy | Accept (molecules adsorb onto catalyst and covalent) bonds weakened | 1 |
| (ii) | silica/silicon dioxide/alumina/aluminium oxide | accept correct formulae<br>accept aluminosilicate(s) accept zeolite(s)<br>ignore silica oxide and alumina oxide<br>If both name and formula given, mark name only | 1 |
| (iii) | $C_2H_4$ | Accept structural or displayed formula | 1 |
| (iv) | ethene | accept ethylene | 1 |

| Question number | Answer | Accept | Reject | Marks |
|---|---|---|---|---|
| 2 (a) (i) | A | Methane | | 1 |
| (ii) | C | Ethene | | 1 |
| (iii) | C | Ethene | | 1 |
| (b) | **M1** – (molecular) $C_4H_{10}$ | $H_{10}C_4$ | $CH_3CH_2CH_2CH_3$ | 1 |
| | **M2** – (empirical) $C_2H_5$ | $H_5C_2$ | | 1 |
| | ECF from molecular formula | | | |
| (c) (i) | **M1** – (name) alkane(s) | | | 1 |
| | **M2** – (general formula) $C_nH_{2n+2}$ | | | 1 |
| (ii) |  | | missing Hs and bonds | 1 |
| | IGNORE bond angles | | | |

| | | | | |
|---|---|---|---|---|
| (d) | **M1 –** incomplete combustion/insufficient oxygen<br><br>**M2** – toxic/poisonous/causes death<br>IGNORE dangerous/harmful<br><br>**M3** – reduces the capacity of the blood to carry oxygen<br>IGNORE references to suffocation/cannot breathe<br>IGNORE blood carries no oxygen | lack of oxygen /less oxygen / <u>only</u> 1½ oxygen (in equation)<br><br>correct references to haemoglobin<br>/blood carries less oxygen/blood does not release oxygen as easily | | 1<br><br>1<br><br>1 |

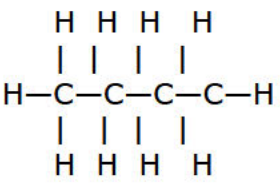
(Total marks for Question 2 = 11 marks)

| Question number | Answer | Accept | Reject | Marks |
|---|---|---|---|---|
| 3 (a) | large hydrocarbons/alkanes/molecules become small ones<br><br>IGNORE references to forming alkenes/ethene/ more useful molecules | (large) hydrocarbons or alkanes or molecules become smaller ones<br><br>long chains become short chains | references to polymers | 1 |
| (b) | **M1** – (add to) bromine (water)/$Br_2$<br>IGNORE Br<br><br>**M2** – (bromine) decolourised/turns colourless<br><br>IGNORE starting colour and clear<br><br>**M2** dep on **M1**, but can be scored for a near miss in **M1**,eg Br or bromide (water) | (acidified) potassium manganate(VII)<br><br>decolourised/turns colourless | | 1<br><br>1 |
| (c) | **M1** – (catalyst) silica / silicon dioxide / alumina / aluminium oxide<br><br>**N.B.** if both name and formula given, mark the name only<br><br>**M2** – 600-700 ºC | correct formula aluminosilicate / zeolite<br><br>any value or range within this range<br><br>equivalent temperatures in Kelvin | | 1<br><br>1 |

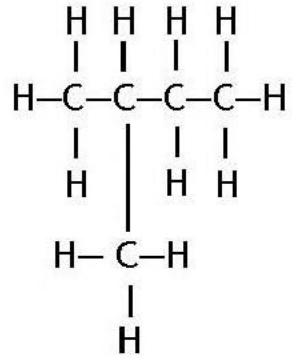
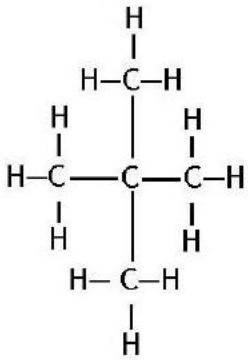
(Total marks for Question 3 = 5 marks)

| Question number | Answer | Accept | Reject | Marks |
|---|---|---|---|---|
| 4 (a) | **M1** (molecules/compounds/substances) with the same<br>molecular formula/number of each type of atoms | hydrocarbons | elements/atoms<br>general formula/empirical formula for **M1** only | 1 |
| | **IGNORE** chemical formula/same compound | atoms arranged differently | | 1 |
| | **M2** (but) different structural formulae/different displayed<br>formulae/different structures | | | |
| (b) | D | | | 1 |
| (c) (i) | **M1** $C_nH_{2n}$ | letters other than n, e.g. | $C_n+H_{2n}$ | 1 |
| (ii) | **M1** double bond between two left hand end carbon atoms | | | 1 |
| | **M2** single bond between each pair of rest of carbon atoms | | | 1 |
| | Penalise max 1 mark for any extra bond shown | | | |
| (d) | **M1** addition | additional | | 1 |
| | **M2** orange | yellow/brown | red, either on its own or in combination with | 1 |
| | **M3** colourless<br>**IGNORE** clear/transparent/looks like water | | any other colour | 1 |
| (e) | **M1** saturated – all (carbon to carbon) bonds are single<br>/contains only (carbon to carbon) | does not contain any multiple/double bonds | | 1 |

| | | | | |
|---|---|---|---|---|
| | single bonds<br><br>**M2** unsaturated - contains (carbon to carbon) double/multiple bond(s) | | | 1 |
| | | | **Total** | **11** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (a) (i) | $CH_4$ | Accept $H_4C$ | |
| (ii) | $C_2H_6$ | Accept $H_6C_2$ | 1 |
| (iii) | $CH_3CH_2CH_3$ | Accept $CH_3$-$CH_2$-$CH_3$ / $H_3C$-$CH_2$-$CH_3$ | 1 |
| (iv) |  | | 1 |
| (b) (i) | alkane(s) | | 1 |
| (ii) | $C_nH_{2n+2}$ | Accept x and other letters in place of n<br>Accept answers like $C_nH_{2n}+2$<br>Ignore brackets that still give same answer | 1 |
| (iii) | similar chemical properties / characteristics / reactions / behaviour | Accept 'same chemical properties' but ignore a specific example, eg all react with oxygen | |
| | same functional group | | |
| | (neighbouring members) differ by $CH_2$ | Accept 'methylene group' | |
| | gradation/gradual change/trend in physical properties | Accept gradation/gradual change/increase/decrease in specified property, eg boiling point<br>Reject same / similar physical properties | |
| | | Accept any two for 1 mark each<br>Accept two answers in lines 1 or 2 | 2 |

| | | | |
|---|---|---|---|
| 5 (c) (i) | $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ | All formulae correct<br>Ignore balanced nitrogen on both sides<br>Balancing dep on M1<br>Ignore state symbols<br>Accept fractions and multiples | 1<br><br><br>1 |
| (ii) | carbon / C | Accept soot<br>Ignore graphite<br>Reject coke | 1 |
| | carbon monoxide / CO | Award 1 for both correct answers in wrong order | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (d) |  | Accept in either order<br><br>Award 1 mark for two correct isomers as structural formulae<br><br>Award 1 mark for two correct isomers as skeletal formulae<br><br>Ignore names | 1 |
| |  | | 1 |
| (e) (i) | UV (light) / ultraviolet (light) | Accept sunlight<br>Ignore ref to temperature | 1 |
| (ii) | bromomethane | Accept 1-bromomethane / methyl bromide / monobromomethane<br>Ignore hyphens / spaces | 1 |
| (iii) | $CH_4 + Br_2 \rightarrow CH_3Br + HBr$ | Award M1 for $CH_3Br$<br>Award M2 for other formulae and correct balancing<br>Max 1 for error in symbol e.g. BR, br<br>Ignore state symbols<br><br>Accept further bromination in (ii) and (iii) | 1<br>1 |

**Total 18 marks**