Gateways School

**Alkanes & Halogenoalkanes**

**Revision PPQ Answers**

41 marks

**Q1.**

(a)     (i)      (Compounds with the) same molecular formula

*Allow same number and type of atom for M1*

*Ignore same general formula.*

**1**

But different structural formula / different displayed formula / different structures / different skeletal formula

*M2 dependent on M1*

*Not different positions of atoms / bonds in space.*

**1**

(ii)     But-2-ene

*Allow but-2-ene.*

*Allow but 2 ene.*

*Ignore punctuation.*

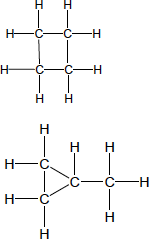
**1**

(iii)    (2)-methylprop-(1)-ene

*Do not allow 2-methyleprop-1-ene.*

**1**

(iv)



*Do not allow skeletal formulae.*

*Penalise missing H and missing C*

**1**

(b)     (i)      C4H8 + 2O2 → 4C + 4H2O

*Accept multiples.*

**1**

(ii)     Exacerbates asthma / breathing problems / damages lungs / smog / smoke / global dimming

*Ignore toxic / pollutant / soot / carcinogen.*

*Do not allow greenhouse effect / global warming / acid rain / ozone.*

**1**

(c)     (i)      C16H34

*Allow H34C16*

*C and H must be upper case.*

**1**

(ii)      Jet fuel / diesel / (motor) fuel / lubricant / petrochemicals / kerosene / paraffin / central heating fuel / fuel oil

*Ignore oil alone.*

*Not petrol / bitumen / wax / LPG / camping fuel.*

**1**

(d)     (i)       C8H18 + 25NO → 8CO2 + 12.5 N2 + 9H2O

*Accept multiples.*

**1**

(ii)      Ir / iridium

***OR***

Pt / platinum

***OR***

Pd / palladium

***OR***

Rh / rhodium

**1**

**[11]**

**Q2.**

(a)     **M1**    (Free-) **radical substitution**

*Both words needed*

**1**

**M2**    Cl2 → 2Cl•

**1**

**M3**    Cl• + CH4 → •CH3 + HCl

**1**

**M4**    Cl2 + •CH3 → CH3Cl + Cl•

**1**

**M5**    CH4 + 3Cl2 → CHCl3 + 3HCl

*Penalise the absence of a radical dot once only*

***Ignore termination steps except, if and only if both*** *M3 and M4 do not score, then accept for one mark  
Cl• + •CH3 → CH3Cl*

**1**

(b)     **M1**    UV (light)/ sunlight / light / UV radiation

**M2**    C–Cl or carbon-chlorine bond breakage  
***OR***homolysis of C–Cl  
***OR***equation to show a chlorine-containing organic  
compound forming two radicals

*For M1 and M2, ignore use of Cl2, but credit UV and C–Cl bond breakage if seen*

**1**

**M3**    Cl• + O3 → ClO• + O2

**1**

**M4**    ClO• + O3 → Cl• + 2O2

*Ignore other equations  
Penalise the absence of a radical dot once only  
Accept radical dot anywhere on either radical.*

**1**

**M5**    Any **one** from

•        Combination 2O3 → 3O2

•        Stated that Cl• / chlorine atom is regenerated / not used up

•        Stated that the Cl• / chlorine atom is unaffected  
by the process.

**1**

*For M5 accept Cl• on both sides of the equation*

**M6**    Stated that the role of the Cl• / chlorine atom is to find an  
alternative route ***OR***lower *Ea* / activation energy

**1**

(c)     **M1**    Halothane contains C–Cl / Cl  
***OR***Desflurane does not contain C–Cl bonds / Cl  
***OR***Desflurane contains C–F / F as the only halogen

*Mark independently.  
For M1, credit the idea that desflurane contains C–F bonds that are difficult to break OR that halothane contains C–Cl bonds which are easy to break.*

**1**

**M2**    Desflurane / molecules that have fluorine as the only  
halogen, cause no damage / do not deplete / do not react  
with the ozone (layer)  
***OR***Halothane / chlorine-containing molecules, damage /  
deplete / react with the ozone (layer)

**1**

**[13]**

**Q3.**

(a)     (base) elimination

*(penalise other words before ‘elimination’ e.g. nucleophilic)*

**1**

**M1**: curly arrow from lone pair of electrons on oxygen of hydroxide ion

*(insist on a lone pair of electrons on the oxygen atom and a negative charge, but only credit this mark if the attack is to a correct H atom)*

**1**

**M2**: curly arrow from the middle of the C-H bond to the middle  
of the C–C bond

**1**

*(only credit this mark if the arrow originates from the correct C–H bond and if an attempt has been made at M1)*

**M3**: curly arrow from the middle of the C–Br bond towards/alongside  
the Br atom

*(credit M3 independently unless the bond breaking is contradicted by an additional arrow)*

*(penalise curly arrow if the C–Br has a formal positive charge)*

*(credit full marks for an E1 mechanism, with M2 awarded for a correct curly arrow on the correct carbocation)*

*(award a maximum of two marks for either an incorrect haloalkane or an incorrect organic product)*

*(maximum 2 marks for use of 'sticks' for the haloalkane, unless RE from 2(b), when credit can be given)*

(b)     (i)      **M1**: compounds with the same structural formula

**1**

**M2**: but the bonds/groups/atoms have different spatial  
arrangements or orientation or configuration/are arranged  
differently in space/3D

*(ignore reference to the same molecular formula for M1)*

**1**

(ii)     **M1**: correct structural representation for cis-but-2-ene and  
its name or its identification as the cis isomer

**1**

**M2**: correct structural representation for trans-but-2-ene  
and its name or its identification as the trans isomer

*(accept representations which are 90° to linear)*

*(award one mark for two correct structures but either wrong/no names)*

*(maximum 1 mark for an incorrect alkene)*

**1**

(iii)     geometric(al) or cis-trans

**1**

(c)     nucleophile or electron pair donor

*(penalise ‘base’)*

**1**

(d)     CH3CH2CH2CH2Br + 2NH3 → CH3CH2CH2CH2NH2 + NH4Br

*(M1 correct product)*

*(M2 balanced equation using 2NH3 and leading to NH4Br)*

*(penalise M1 for use of C4H9NH2 or for incorrect haloalkane, but allow consequent correct balancing of equation with 2 moles of ammonia)*

**2**

(1–)butylamine

*(credit 1–aminobutane and butyl–1–amine)*

*(award QoL mark for correct spelling)*

**1**

**[13]**

**Q4.**

D

**[1]**

**Q5.**

A

**[1]**

**Q6.**

C

**[1]**

**Q7.**

B

**[1]**