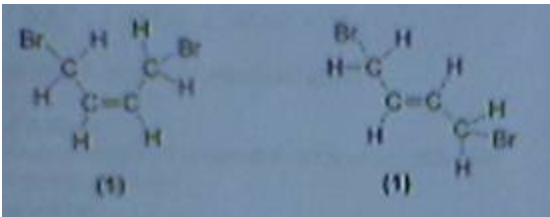
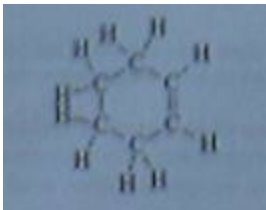


June 2003 Unit 2

- 1)a) i) White / colourless
ii) Yellow / orange
iii) $2\text{Br}^- + \text{Cl}_2 \rightarrow \text{Br}_2 + 2\text{Cl}^-$ ACCEPT multiples
iv) Separate layers – stated or implied (1)
Organic / hydrocarbon / upper layer coloured orange (1)
- b) i) Sulphur / S } (1)
Bromine / Br }
- S: initially -2, finally +1 sign needed (1)
Br: initially 0, finally -1 (1)
- ii) $2 \times +3 = +6$, $6 \times -1 = -6$
OR total change in ON of S = +6, total change in ON of Br = -6
OR Up 6, down 6
OR 6 electrons lost, 6 electrons gained
- c) i) Greater **Van der Waals** attractions in HI / iodine (1)
because it has more **electrons** (1)
Can be from a HBr perspective
- ii) Hydrogen / H bonding in HF (but not in HBr or HI)
- iii) Within range 174 to 195 (actually 188) (K) (1)
Fewer electrons than in HBr (but no hydrogen bonding) / weaker van der Waals forces than in HBr (1)
- 2)a) i) **Two** reactants form **one** product
ii) **Substitution** reactions occur under these conditions
iii) The electrons of the double bond polarise the Br-Br molecule(1)
and Br^{2+} is the electrophile (1)
OR show...attracting in the correct orientation
- b) i) 
(1) (1)

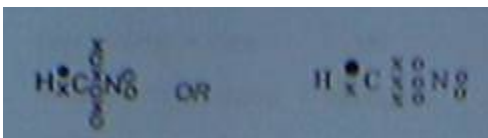
- ii) No rotation about a C=C double bond
OR only single bonds can rotate

c) i)

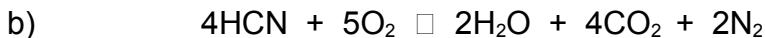


- ii) Low temperature because exothermic reaction (1)
High pressure because fewer molecules of product than of reactants / gases are being converted into liquids (1)

3)a) i)



- ii) 180° (1)
Two regions / areas of negative charge / electrons repel so as to be as far apart as possible (1)



c) Mark according to quality of argument given

No mark if answer...

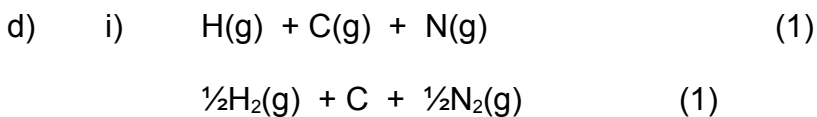
- Effectively re-quotes the question without amplification
- Is chemically unsound
- Is nonsensical

Answer must come to a conclusion and then look...

for EITHER a sophisticated statement about dangers of HCN OR the usefulness of perspex.

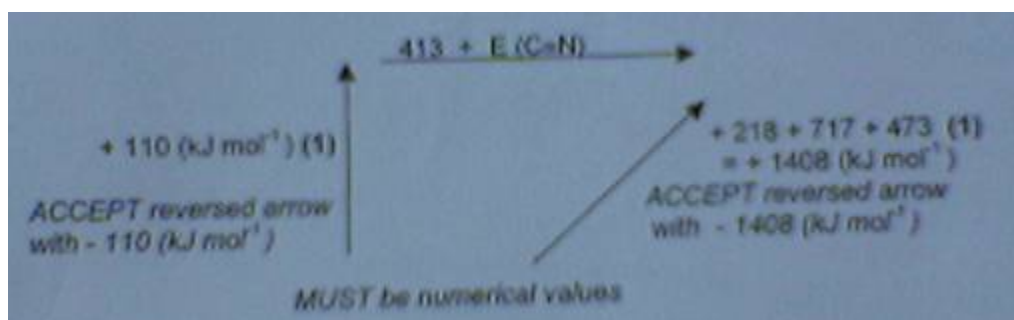
Not enough to say "No, because it is very toxic", but a developed point such as "Danger of an escape of HCN is an unacceptable risk to local residents" would score.

Alternatively, an argument in favour of its use could be based on the existence of adequate risk assessment and/or procedures for evacuation in the event of an emergency or need for a safer alternative to glass or other justification for use of perspex.



All formulae correct but missing state symbols **1 max**

ii)



iii) $E(\text{C}=\text{N}) = 1408 - 110 - 413$
 $= +885 \text{ (KJ mol)}$

4)a) i) 1,2-dichloroethane

ii) $\text{CH}_2=\text{CHCl}$ / CH_2CHCl

iii) eg dissolve / bubble HCl in water / absorb in an alkali / condense the HCl(g)

b) i) Species having unpaired electron

ii) Action of UV radiation / sunlight / named initiator / photoflood

c) i) Water / OH^-

ii) Unshared / lone pair of electrons on a legitimate nucleophile based on (c)(i) (1)

(c)(i) "nucleophile" attacks / forms bond with C of C-Cl (1)

- iii) Chloride ion / Cl⁻
- iv) Add silver nitrate solution (1)
whit ppt (1)
- 5)a) Reactions producing the smog require / involve sunlight
- b) $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
- c) If combustion is complete, the only products are carbon dioxide and water
incomplete combustion gives CO / carbon / soot / unburnt hydrocarbons
NOT SUFFICIENT to say "not all fuel is burnt / not fully oxidized"
- d) Higher temperature in conventional engines / lower temperatures used in lean-burn (or diesel) engines
- e) Iridium / silver / osmium / ruthenium / gold
- f) Fuel must be of very low sulphur content / unleaded because sulphur / lead compounds 'poison' / affect the catalyst
- g) The catalyst / engine / exhaust system is too cold / isn't hot enough / temperature of 150 / 200 / 240°C needed
- h) **Key Points:**
 1. converter contains platinum supported on a **ceramic honeycomb**
 2. uses NO_x / oxides of nitrogen to **oxidize** carbon monoxide **and** hydrocarbons / the other pollutants
 3. air fuel proportions controlled by fitting **oxygen sensors**
 4. linked to **electronically / computer** controlled fuel injection systems
 5. **efficiency is improved** by including rhodium / palladium / other platinum group metals
 6. diesel-engined vehicles need a filter to remove carbon / soot
 7. Nitrogen oxides are converted to nitrogen dioxide with a platinum catalyst...

8. ...and the nitrogen dioxide then oxidizes the carbon / soot at 200°C / low temperature.

Any six