ENVIRONMENTAL CHEMISTRY HW MS

1. (i) $C_7H_{16} + 11½\ O_2$ **(1)** $\rightarrow 7CO_2 + 8H_2O$
products **(1)**
balance **(1)** 2

(ii) absorb IR **(1)**
C=O bonds vibrate. **(1)** 2

[4]

2. (i) $M_r\ C_7H_{16} = 100$ **(1)**
amount = 2000/100 = 20 mol **(1)** 2

(ii) energy saved = 20 × 4817 = 96340 kJ **(1)** 1

(iii) moles $CO_2 = 7 \times 20 = 140$ mol **(1)**
decrease in $CO_2 = 140 \times 24 = 3360\ dm^3$ **(1)** 2

[5]

3. O_2
C*l*O **(1)** (both needed)

$O_3 + O \rightarrow 2O_2$ **(1)**

[2]

4. The C–Halogen bond most likely to be broken is **C–Br** because it is the weakest bond

[1]

5. (i) C*l*O + **O** $\rightarrow$ C*l* + O_2 ✓ 1

(ii) $O_3 + O \rightarrow 2O_2$ ✓ 1

(iii) effect of uv radiation/ homolytic fission/
effect of sunlight ✓ 2
on CFCs/ on chlorocarbons ✓

(iv) increase (skin cancer) ✓ 1

[5]

6. **(i)** O_2

ClO

$O_3 + O \rightarrow 2O_2$

(ii) The catalyst is Cl

because it is used in the first step and regenerated in the second

[5]

7. NO and CO are adsorbed onto the catalyst surface

chemical reaction on the catalyst surface

desorption of N_2 and CO_2 from the catalyst surface

[3]

8. CO from incomplete combustion/ insufficient oxygen ✓
NO from nitrogen and oxygen in **the air** ✓

[2]

9. (a) (i) $C_8H_{18} + 121/2O_2 \rightarrow 8CO_2 + 9H_2O$

reagents and products (1)

balancing (1) 2

(ii) from nitrogen in air and oxygen (1) 1

(b) (i) any two from Pt/ Rh/ Pd 1

(ii) adsorbed (1)

bonds within molecule weakened (1)

desorbed/ description (1) 3

(iii) $CO + NO \rightarrow 1/2N_2 + CO_2$

reagents and products (1)

balancing (1) 2

(c) ozone/ NO_2/ nitric acid (1) 1

[10]

10. **Availability of starting materials:**

availability

sugar is renewable because it can be grown **(1)**
ethane is finite because it is obtained by processing of crude oil **(1)**

energy:

fermentation: energy is required for distillation/
hydration: energy is required to generate steam **(1)**

atom economy and waste products:

atom economy for fermentation < atom economy hydration **(1)**
In fermentation, CO_2 is produced in addition to ethanol/ethanol is not the only product **(1)**
In hydration, ethanol is the only product/hydration is an addition reaction (1)
Atom economy of fermentation could be increased by finding a use CO_2 (1)

Atom economy linked to a chemical equation to show that hydration has 100% atom economy/fermentation has 51% atom economy **(1)** 7max

[7]