1.
(a) CO_2 / NO_3^-
(b) CH_4 / NH_3
(c) $6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$

2.
(a) - high heat/energy allows nitrogen gas to combine with oxygen
- NO then combines further with oxygen to produce NO_2
[equation must be present, worth 2 marks as it must be balanced]
(b) photochemical smog -OR- tropospheric ozone -OR- similar (enhanced greenhouse effect accepted with stern warning)
(c) It is produced directly in the car engine / not by a primary pollutant reacting in the atmosphere, so it is a primary pollutant.
(d) Catalytic converters provide the activation energy for the reaction of nitrogen oxides into nitrogen gas.
(e) - nitrogen oxides react with water in rainfall to produce nitric and nitrous acids
- these ionise and fall to the ground as nitrate and nitrite ions
- these are nutrients in soluble form, so available to plants

3.
(a) The Earth's surface absorbs short-wave radiation (UV and visible light) from the sun and re-emits it as longer-wave radiation (infra-red). Greenhouse gases in the atmosphere have polar covalent bonds which stretch and bend to absorb the IR, thereby warming the Earth's atmosphere.
(b) Enhanced greenhouse effect.
(c) It will cause climate change which affects water collection and crops disrupting the human population.
-OR- It will cause polar ice caps to melt, causing coastal flooding which disrupts the human population

4.
(a) 5.6
(b) $\left[H^+\right] = 10^{-pH} = 10^{-4.9} = 1.3 \times 10^{-5}$ mol L^{-1}
(c) SO_3 reacts with rainwater to produce sulfuric acid, which then ionises, increasing [H+] (lower pH)
[equation must be present, worth 2 marks as it must be balanced]
(d) The acid produced by reaction of CO_2 with water is a weak acid, therefore won't lead to much increase in $[H^+]$.
(e) [see notes for options]

5.
(a) Suspended clay particles have a negative surface charge and so will be attracted to these cations. The clay particles join together with the Al^{3+} ions to form larger sized particles which cannot stay in solution.
(b) To kill bacteria.
(c) Lower concentration
(d) $pOH = -\log\left[OH^-\right] = -\log\left(3.6 \times 10^{-5}\right) = 4.4$
$pH = 14 - pOH = 14 - 4.4 = 9.6$