1 (a (i) $CH_3–CH_2–CH_2–OH$                                                                          [1]
        **NOT**: $C_3H_8O$
        between 2030 and 2050                                                                         [1]

    (ii) $C_5H_{11}OH + 7½ O_2 \rightarrow 5CO_2 + 6H_2O$                                              [1

(b) any three from:
    same general formula
    same functional group
    same chemical properties
    same methods of preparation
    accept consecutive members differ by $CH_2$                                                       [3]

(c)     same molecular formula                                                                        [1]
        different structures / different structural formulae                                          [1]

    (ii) $CH_3–CH_2–CH(OH)–CH_3 / (CH_3)_3C–OH$

(d)     number of moles of glucose = 72/180 = 0.4                                                      [1]
        maximum number of moles ethanol = 0.8                                                          [1]
        maximum mass of ethanol, $M_r$ = 46 g, 0.8 × 46 = 36.8 g                                       [1
        **or**
        180 (g) produces 2 × 46 = 92 (g) (1)
        (72 (g) produces) 72/180 × 92 (1)
        = 36.8 (g) (1)

    (ii) crack (petroleum or alkane)                                                                   [1]
         react with water / hydrate (ethene to make ethanol)                                           [1]

         conditions for cracking
         (temperature) 450 to 800 °C / (catalyst) zeolites / aluminosilicates / silica / aluminium
         oxide / alumina / china / broken pot / chromium oxide
         **or**
         conditions for hydration
         (temperature) 300 °C / (pressure) 60 atmospheres /
         (catalyst) phosphoric acid                                                                    [1]

**[Total: 15]**

2 **(a** **(i)** correct word equation (carbon dioxide and water) **[1]**
**Accept** correct symbol equation

**(ii)** Must have a correct reagent otherwise wc = 0
add (acidified) barium chloride(aq) **or** nitrate **or** add barium ions **[1]**
**COND** white precipitate **[1]**
**NOT** lead(II) compounds

**(iii)** low pH **or** universal indicator turns red(aq) **[1]**
pH 3 **or** less

**(b)** $H_2S + 2O_2 = H_2SO_4$ **[2]**
unbalanced [1]

**(ii)** unpleasant smell **or** it is poisonous **or** when burnt forms acid rain **or** forms sulphur
dioxide **or** forms sulphuric acid **[1]**
**NOT** it is a pollutant

**(iii)** 2H to 1S
**COND** 8e around sulphur atom
2e per hydrogen atom
**THREE** correct **[2]**
**TWO** from above [1]
Ionic structure = [0]

**(c)** vanadium oxide **or** vanadium(V) oxide **or** vanadium pentoxide or $V_2O_5$
Must be correct oxidation state if one given **[1]**

**(ii)** 400 to 500$^o$ C **[1]**

**(iii)** add to (concentrated) sulphuric acid **NOT** dilute **[1]**
**COND** (upon sulphuric acid) above then add water **[1]**

**(d)** mass of one mole of $CaSO_4$ = 136
moles of $CaSO_4$ in 79.1g = 0.58 accept 0.6 **[1]**
moles of $H_2O$ in 20.9 g = 1.16 accept 1.2 **[1]**
**conseq** x = 2        x given as an integer **[1]**

**TOTAL = 16**

3 (a) (i) 40          [1]

          80 **or** 40         [1]

          1          [1]

      (ii) particles have more energy **or** moving faster         [1]

          collide more frequently

          **or** collide with more energy         [1]

     (iii) greater surface area         [1]

     (iv) flour mills **or** coal mines **or** metal powders         [1]

          **or** fireworks **or** gunpowder

   (b) (i) collect and measure <u>volume</u> of oxygen         [1]

          **or** mass **or** count bubbles

          time         [1]

      (ii) measure rate in different light levels and comment         [1]

          accept if dark no reaction

   (c) (i) $+6O_2$         [2]

          not balanced that is just $O_2$ **ONLY** [1]

      (ii) linkage ---O----         [1]

          chain         [1]

          minimum to be accepted