Student Book Unit 4  Test 2 Mark scheme (Chapters 1.6 to 1.7)

1  a  Object and mirror-image are non-superimposable / contains a carbon atom with four different groups (1)
    accept asymmetric molecule
    not asymmetric carbon atom or rotates the plane of polarised light

   b  (i) Rotates (plane of polarisation of) plane-polarised (monochromatic) light or has a non-superimposable mirror image (1)
     not bends/twists light
     if they say 'contains chiral carbon' this must be explained or indicated on the diagram for (1)

     (ii) Structure (1); correct mirror image (1)
          must be 3D drawing for (2) – if it is drawn flat only (1)
          if a correct mirror image of an incorrect but chiral compound then (1) – the chiral compound must be feasible to get this mark

    c  (i) A species with a lone pair of electrons to donate (1)
        not 'seeks protons in nucleus' or 'nucleus loving' or 'has a negative charge'

        (ii) \( \text{CH}_3\text{CH}_2\text{CH(OH)}\text{CH}_3 \) (1)
          consequential alcohol on answer to part b (ii)
          the structure must be sufficiently clear to show butan-2-ol

          \[
          \begin{array}{cccccccc}
            & & H & & \text{C} & & H & & H \\
            & & & & \text{H} & & \text{H} & & \text{H} \\
            & & & & \text{H} & & \text{H} & & \text{H} \\
          \end{array}
          \]

          is OK

        (iii) Add \( \text{PCl}_5 \) (1); (steamy) (acid) fumes / white gas (1)
              if \( \text{PCl}_5(\text{aq}) \) then (0)
              any other suitable test and result acceptable e.g.
              sodium (1); bubbles (1)
              potassium dichromate(VI) (1); green (1)
              potassium manganate(VII) (1); brown/colourless (1)
              add carboxylic acid and conc. sulfuric acid (1); sweet smell (1)
              \( \text{I}_2/\text{NaOH} \) or \( \text{KI}/\text{NaClO} \) (1); yellow ppt. (1)
              consequential on answer given to part c (iii)

    d  (i) hydrolysis / saponification (1)
        not substitution

        (ii) Yield falls; reaction with acid is an equilibrium (1)

    e  (i) Ethanoic acid (1)

        (ii) \( \text{CH}_3\text{COOH} / \text{CH}_3\text{COO}^- \) (1)

        (iii) \( \text{HCl}/\text{H}_2\text{O}^+ \) is a stronger acid (1) than ethanoic acid (1)
              or \( \text{CH}_3\text{COO}^- \) strong base (1) whereas \( \text{Cl}^- \) weaker base (1)

(Total 14 marks)
2  a  A – F – G – C – D – E – B (2)
   (1) if one letter out of sequence but rest correct; (0) if two or more letters out of sequence
   if adjacent pair inverted this is one error.

   b  Little – to produce a saturated solution / to prevent loss of solid /
   because all solid will not crystallise / to prevent loss of yield. (1)
   Small – (if large volume used) solid would be lost/dissolved (1) (2)

   (Total 4 marks)

3  a  Reasoning/identification of peaks:
   3 types of H ratio 6 : 1 : 1 or some correct reference to height of peaks (1)
   this related to structure of propan-2-ol in shift data (1) (2)

   b  Yellow ppt. (1); hospital smell (1) (2)

   c  (1)

   d  Propene (1); dehydration/elimination (1) (2)

   (Total 7 marks)

4  a  (Wear) gloves / add slowly / cool while adding (1)
   if multiple answers correct and incorrect (0)
   not lab. coat / be careful not to spill on hands / do in a fume cupboard (1)

   b  (i)

   Flask (round or pear shaped only) + heat (1)
   Vertical condenser (double surface and water inlet and outlet) (1) (2)
   not sealed, no gaps, joint shown between flask and condenser safe
   not distillation, if water in/out labelled they must be correct
(ii) (Fractionally) distil (1)

Collect fraction that distils over at about 56°C / stated range 55–57°C or 54–58°C (1)

- a temperature value / range must be quoted
- not ‘collect fraction above 56°C’
- mark independently

(2)

c PCl₅ / SOCl₂ (1); no steamy fumes / no gas which turns blue litmus red (1)

or K₂Cr₂O₇ + H₂SO₄ (1); no colour change / stays orange (1)

or KMnO₄ + H₂SO₄ (1); no colour change / stays purple (1)

or Na (1); no bubbles / no effervescence (1)

name or formula can be given

ignore oxidation numbers unless they are incorrect

results may be given as negative tests – or as ‘if propan-2-ol was present there would be steamy fumes’

result mark is dependent on correct reagent but may have result mark if minor error in reagent

must be a chemical test – e.g. not ‘check that boiling point is 56°C exactly’

(Total 7 marks)