Diffusion, Brownian Motion, Solid/Liquids/Gases

Mark Scheme 2

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TimeAllowed: 60 minutes
Score: /50
Percentage: /100
1 (a) explanation of evaporation e.g. particles (or molecules) with a lot of energy leave the liquid / bromine particles break free from each other / forces or bonds between bromine molecules broken / molecules (in liquid) have weak forces holding them together / weak intermolecular forces / Van der Waals forces between molecules (don’t have to be stated as weak) / (weak intermolecular forces alone scores this mark);

allow: particles (or molecules) of bromine escape from liquid [1]

diffusion / diffuse / movement of particles; [1]

explanation of diffusion involving qualified movement of molecules / particles i.e. random movement of molecules / particles move in all direction [1]

(b) air more dense / heavier / higher M, than hydrogen; [1]
hydrogen diffuses faster (than air diffuses out); [1]
accept: diffusion in is faster than out (without naming gases)
pressure inside pot is greater (than outside); [1]
air less dense / lighter / lower M, than carbon dioxide; [1]

air diffuses / moves faster (than carbon dioxide);
accept: diffusion out is faster than in (without naming gases)

pressure inside pot less (than outside);

ORA in both parts [Total: 9]
(a) \( 27p \ 32n \ 27e \)
\( 27p \ 32n \ 25e \)

(b) (i) same proton number / same number of protons / same atomic number
different nucleon number / different number of neutrons / different mass number

(ii) same electron distribution
allow: same proton number and same number of electrons
not: same number of electrons / same number of shells

(iii) industrial detection of leaks / thickness of paper etc. / nuclear fuel for generating electricity / nuclear weapons / radiographs of welds / measuring wear / sterilising food
not: carbon dating

medical treatment of cancer, radiotherapy, treatment of thyroid gland, X rays, tracer studies in body, sterilising equipment, locating tumours
accept: X-rays only once
3  (a) E  
(b) A C E need all three  
(c) A  
(d) F  
(e) C  
(f) D F need both but not more  

[Total: 6]
4  (a)  (i)  6e between two nitrogen atoms (can be any combination of dots or crosses)  

1 lone pair on each nitrogen atom  

(ii)  SOLID  GAS  

<table>
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<tr>
<th>PATTERN</th>
<th>regular / lattice (not fixed)</th>
<th>random / irregular / no pattern</th>
</tr>
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<tr>
<td>DISTANCE</td>
<td>close</td>
<td>far apart / spread out</td>
</tr>
<tr>
<td>MOVEMENT</td>
<td>vibrate / fixed / no motion</td>
<td>moving / translational</td>
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(b)  (i)  **particles/molecules** have more energy / move faster  

collide harder / collide more frequently / more collisions / collide with more force (with the walls)  

(ii)  (1) nitrogen has smaller *M* / lighter molecules / lower density  
nitrogen **molecules** / **particles** move faster (than chlorine molecules)  

(2) at higher temperature nitrogen **molecules or particles** (not atoms) move faster / have more energy  

[Total: 10]
(a) (i) darker or actual colours
   chlorine    yellow, yellow/green
   bromine    orange, brown, brownish red
   iodine      black grey, purple

   (ii) gas, liquid, solid
        all three needed

   (iii) colourless or (pale) yellow
          gas

(b) Must have a correct reagent otherwise wc = 0

   add chlorine water or bubble in chlorine gas
   yellow or orange or brown
   dark brown or grey crystals
   (Accept colour that is darker than for bromide)

   OR add (acidified) silver nitrate(aq)
   off white or pale yellow or cream precipitate or soluble in aqueous ammonia
   yellow precipitate insoluble in aqueous ammonia
   precipitate essential then either colour or solubility in aqueous ammonia

   OR add lead nitrate(aq)
   pale yellow or off white or cream precipitate
   yellow precipitate insoluble in aqueous ammonia

   Accept any test that could work – electrolysis, iron(III) salt
   bromine, potassium dichromate, potassium manganate(VII) etc.

(c) \[ I_2 + 3Cl_2 = 2ICl_3 \] [2]
   For having either reactants or products correct ONLY [1]

(d) chlorine
   COND lower M, or lower density or lighter molecules or molecules move faster [2]

   OR lighter or based on \( A_r \), MAX [1]
       smaller with no additional comment or sieve idea [0]

TOTAL = 12
6. (a) Group II metals will lose 2e
    Group VI elements will gain 2e

(b) \( \text{SCl}_2 \)
    COND 8e around both chlorine atoms
    8e around sulphur with 2nbp and 2bp
    If x and o reversed ignore if this is the only error

(c) Ions cannot move in solid or can move in liquid

(ii) No ions in sulphur chloride or it is covalent or only molecules or only strontium chloride has ions

TOTAL = 7