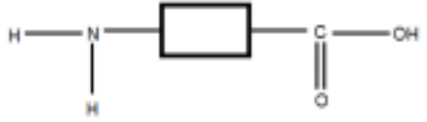


- 1 (a) (i) 6e between two nitrogen atoms; note: can be any combination of dots or crosses [1]
 1 lone pair on each nitrogen atom; [1]
- (ii)
- | | | | |
|-----------|--------------------------|----------------------------------|-----|
| | solid | gas | |
| pattern: | regular / lattice | random / irregular / no pattern; | [1] |
| distance: | close | far apart / spread out; | [1] |
| movement: | vibrate / fixed position | moving; | [1] |
- note: comparison must be made
- (b) particles have more energy / move faster; [1]
 collide harder / collide more frequently / more collisions / collide with more force; [1]
 allow: molecules instead of particles
- (c) (i) nitrogen has smaller M_r ; [1]
 nitrogen (molecules) move faster (than chlorine molecules) / ora; [1]
 note: comparison must be made
- (ii) (at higher temperature) molecules move faster / have more energy [1]

Question	Answer	Marks
2(a)(i)	$\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$;	1
2(a)(ii)	di	1
2(a)(iii)	solid forms at: A; explanation: ammonia molecules/particles have a smaller mass; (and so) move/diffuse faster;	1 2 3
2(a)(iv)	M1 solid forms in less time/faster/quicker; M2 particles/molecules have more energy; M3 (and so) move faster/diffuse faster;	1 1 1 3
2(b)(i)	test: add sodium hydroxide (solution and warm); result: test gas/ammonia with (red) litmus/Universal Indicator/pH paper; indicator turns blue/ammonia produced;	1 2 3
2(b)(ii)	test: add silver nitrate (solution); result: add (dilute) nitric acid; white precipitate;	1 2 3

Question	Answer	Marks
2(c)(i)	cov	1
2(c)(ii)	M1 one shared pair of electrons between each N and H; M2 one shared pair of electrons between the N atoms; M3 one lone pair on each N and no additional electrons anywhere;	1 1 1
(d)(i)		1
2(d)(ii)	proteins are made from more than two monomers; OR nylon is made from 1 or 2 monomers (only);	1
2(d)(iii)	acids;	1
2(e)	 <p>The diagram shows a chemical structure of an amino acid backbone. On the left, a nitrogen atom (N) is bonded to two hydrogen atoms (H), one above and one below. The nitrogen atom is also bonded to a central carbon atom (C). This central carbon atom is bonded to a hydrogen atom (H) on the left and a carbonyl group (C=O) on the right. The carbonyl group consists of a carbon atom double-bonded to an oxygen atom (O) below it and single-bonded to a hydroxyl group (OH) on the right. A rectangular box is drawn around the bond between the central carbon atom and the carbonyl carbon atom, indicating a missing group. A semicolon (;) is placed below the structure.</p>	1

- 3 (a) (i) $X(s) \leftrightarrow X(l)$ [1]
- (ii) melting point/freezing point (of X) [1]
- (iii) gas/gaseous or vapour [1]
- (iv) not horizontal **or** line slopes **or** line is lower [1]

- (b) (i) 14.3 [1]
- (ii) $85.7 \div 12$ and $14.3 \div 1$ **or** 7.14 and 14.3 [1]
 ratio 1:2 [1]
 CH_2 [1]
note: Award all 3 marks for correct answer
allow: alternative working e.g.
 $85.7 \times 84 \div 100$ and $14.3 \times 84 \div 100$ **or** 71.988/72 and 12/12.012 [1]
 6:12 **or** ratio 1:2 [1]
 CH_2 [1]
- (iii) C_6H_{12} [1]

[Total: 9]

- 4 (a) (i) (particles) spread to fill total available volume / move from high concentration to low concentration / moves down a concentration gradient (1) [1]
- (ii) mass or M_r (1) [1]
- (b) helium atoms / molecules are lighter than molecules in air or N_2 **and** O_2
or helium is less dense than air or N_2 **and** O_2 .
or helium diffuses (through the porous barrier) faster than air or N_2 **and** O_2 . (1) [1]
- (ii) faster rate of diffusion / molecules move faster (at high temperatures). (1) [1]
- (c) (i) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (1) [1]
- (ii) would get a mixture of helium and carbon dioxide
or would get a mixture of gases
or waste of methane / natural gas / fossil fuel (1) [1]
- (iii) fractional distillation (1) [1]

[Total: 7]

- 5 (a) any **three** from:
particles have more energy (1)
move faster (1)
collide more frequently (1)
more particles have energy greater than E_a [3]
guidance: more colliding molecules have enough energy to react is worth (2)

- (b) particles move in all directions / randomly in both liquids and gases (1)
no bonds / very weak forces between particles in gases (1)
molecules can move apart / separate (to fill entire volume) (1)
OR
bonds / forces / IMF between particles in liquids (1)
molecules cannot move apart / separate (so fixed volume in liquids) (1) [3]

[Total: 6]

- 6 (a) liquid; [1]
- (b) (l) and (s); [1]
reversible sign; [1]
accept: X in equation
ignore: any compounds just look for state symbols
must be the same compound on both sides of equation
- (c) boiling / condensation; [1]
accept: evaporation or vaporisation
- (d) (in region BC) solid melts / liquid boils (in region DE); [1]
at one / fixed / sharp / single / specific temperature; [1]

[Total: 6]