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]

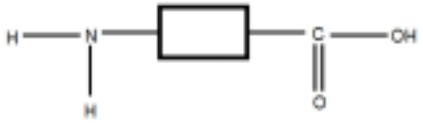
note: comparison must be made

(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)	$NH_3 + HCl \rightarrow NH_4Cl$;	**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;	**3** 1 2
2(a)(iv)	**M1** solid forms in less time / faster / quicker; **M2** particles / molecules have more energy; **M3** (and so) move faster / diffuse faster;	**3** 1 1 1
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;	**3** 1 2
2(b)(ii)	test: add silver nitrate (solution); result: add (dilute) nitric acid; white precipitate;	**3** 1 2

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;	**3** 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)	 ;	**1**

3 **(a) (i)** (X(s) ↔) 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 ÷ 12 and 14.3 ÷ 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 × 84 ÷ 100 and 14.3 × 84 ÷ 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) <u>fractional</u> 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 <u>in both</u> 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]