1 **(a** suitable particles and fluid, and labelled, in suitable container
e.g. pollen and water (surface), smoke in air M1
microscope AND, if smoke used, illumination A1

(b) movement of particles NOT atoms or molecules B1
reasonable description of movement
OR any mention / clear description of movement in different directions
accept if diagram drawn B1

(c) collisions between molecules and particles B1
random movement of molecules OR causes (random) motion of particles B1

[Total: 6]

2 **(a** (molecules) move in random directions / randomly / with constant random motion / zig-zag motion / in all directions B1

(molecules) have random speeds OR a range of speeds OR move (very) fast / at (very) high speed B1

any 1 from:
(molecules) collide with each other
(molecules) move in straight lines between collisions
(molecules) change direction in collisions
(molecules) collide with walls (of cylinder) B1

(b) (i) pressure increases M1

more frequent collisions between molecules and walls
OR molecules collide with walls more often / at greater rate A1

(ii) pV = constant
OR $p_1V_1 = p_2V_2$ in any form
OR $1.0 \times 10^5 \times 500 = p_2 \times 240$ C1

2.1×10^5 Pa to 2 or more sig. figs A1

[Total: 7]

3 **(a (i)** reduces (rate of evaporation) NOT zero (rate of evaporation) M1

no / fewer evaporated molecules removed by wind
OR greater humidity / vapour pressure
NOT fewer molecules in liquid / puddle blown away A1

(ii) increases (rate of evaporation) M1

molecules move faster / have more energy OR more molecules have energy to escape A1

(b) greater (rate of evaporation) OR rate is less in <u>small</u> puddle
ignore rate of disappearance of puddle B1

surface areas correctly compared B1

(c) description of viable experiment NOT absorption expt M1

statement of measurements to be made A1

good detail e.g. thermometers in comparable positions OR pyrometer same position relative to different surfaces A1

[Total: 9]

4 **(a (i)** molecules in random arrangement B1

molecules similar distance apart B1

(ii) molecules in random arrangement **AND** further apart B1

(b) (i) gas ringed / indicated

(ii) more room for molecules **OR** molecules fit into gaps **OR** there are gaps between molecules B1

no repulsive forces between molecules **OR** (repulsive) forces between molecules smaller **OR** pressure on walls smaller **OR** only small force / pressure required B1

[Total: 6]

5 **(a (i)** diagram showing:
molecules widely spaced B1
molecules randomly positioned B1

(ii) (attractive) forces (much) smaller between gas molecules B1
gas molecules (much) farther apart B1

(b) pV = constant **OR** $p_1V_1 = p_2V_2$ **OR** (V_2 =) p_1V_1/p_2
OR (V_2 =) $2.75 \times 10^6 \times 6 \times 10^{-3} / 1.1 \times 10^5$ C1
= $0.15\,m^3$ C1
(no. of balloons = $(0.15 - 6 \times 10^{-3}) / 3 \times 10^{-3}$ =) 48 A1

(ii) pressure of air in balloon increases B1
molecules move faster **OR** hit balloon surface harder / more often
OR larger force rips / breaks rubber **OR** balloon expands B1

[Total: 9]

6 **(a** diagram shows (molecules) randomly positioned M1
diagram shows <u>most</u> (molecules) touching/very closely spaced A1

(b) (i) (temperature) decreases B1

(ii) <u>more energetic</u>/faster molecules escape from surface/overcome forces of attraction B1

(iii) $E = ml$ in any form **OR** ml C1
2900 J A1

(iv) any two from:
- cover/decrease surface area
- reduce temperature
- reduce draught owtte
- increase humidity of air B2

[Total: 8]

7 **(a** pV = constant **OR** $p_1V_1 = p_2V_2$ **OR** p_1V_1 / V_2 or $1.0 \times 10^5 \times 100 \div 40$ C1
2.5×10^5 Pa A1

(b) (i) (the particles move) <u>randomly</u> B1

(the particles move) slowly **OR** through small distances **OR** disappear **OR** zigzag **OR** directions change **OR** erratic **OR** straight lines between collisions B1

(ii) air <u>molecules</u> / <u>particles</u> collide with smoke particles (at high speed) B1
fast(er) air molecules **OR** move randomly **OR** many collisions B1

(c) diagram showing:
<u>molecules</u> touching each other B1
<u>molecules</u> positioned in an ordered structure B1

[Total: 8]