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

   **b** movement of particles NOT atoms or molecules
   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
   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
   
   (molecules) have random speeds OR a range of speeds OR move (very) fast/at (very) high speed
   
   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
   more frequent collisions between molecules and walls
   OR molecules collide with walls more often/at greater rate
   
   M1

   (ii) \( pV = \) constant
   OR \( p_1V_1 = p_2V_2 \) in any form
   OR \( 1.0 \times 10^5 \times 500 = p_2 \times 240 \)
   \( 2.1 \times 10^5 \) Pa to 2 or more sig. figs
   
   C1

   [Total: 7]
3 (a) (i) reduces (rate of evaporation) NOT zero (rate of evaporation) 
no/fewer evaporated molecules removed by wind
OR greater humidity/vapour pressure
NOT fewer molecules in liquid/puddle blown away

(ii) increases (rate of evaporation)
molecules move faster/have more energy OR more molecules have energy
to escape

(b) greater (rate of evaporation) OR rate is less in small puddle
ignore rate of disappearance of puddle
surface areas correctly compared

(c) description of viable experiment NOT absorption expt
statement of measurements to be made
good detail e.g. thermometers in comparable positions OR pyrometer same
position relative to different surfaces

[Total: 9]

4 (a) (i) molecules in random arrangement
molecules similar distance apart

(ii) molecules in random arrangement AND further apart

(b) (i) gas ringed/indicated

(ii) more room for molecules OR molecules fit into gaps OR there are gaps
between molecules
no repulsive forces between molecules OR (repulsive) forces between
molecules smaller OR pressure on walls smaller OR only small
force/pressure required

[Total: 6]
(a) (i) diagram showing:
molecules widely spaced
molecules randomly positioned

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

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

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

[Total: 9]

6 (a) diagram shows (molecules) randomly positioned
diagram shows most (molecules) touching/very closely spaced

(b) (i) (temperature) decreases

(ii) more energetic/faster molecules escape from surface/conquer forces of attraction

(iii) \( E = ml \) in any form OR \( ml \)
\( 2900 \text{ J} \)

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

[Total: 8]
7  (a) \[ pV = \text{constant OR } p_1V_1 = p_2V_2 \text{ OR } p_1V_1/V_2 \text{ or } 1.0 \times 10^5 \times 100 \div 40 \] 
\[ 2.5 \times 10^5 \text{ Pa} \]  

(b) (i) (the particles move) randomly  
(the particles move) slowly OR through small distances OR disappear OR zigzag OR directions change OR erratic OR straight lines between collisions  

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

(c) diagram showing:  
molecules touching each other  
molecules positioned in an ordered structure  

[Total: 8]