MARK SCHEME
THERMAL + MATERIAL

1. $p = \rho g h$ ✓①

$= 1000\ kg/m^3 \times 10\ m/s^2 \times 50\ m$ ✓①

$= 500\,000\ N/m^2$

$= 5 \times 10^5\ Pa$ ✓①

2 ✗

(a) (i)	random	B1		
(ii)	hit and rebound	B1		[2]
(b) (i)	increase or further apart	B1		
(ii)	increase or move faster	B1		[2]
(c) (i)	random, fast in gas to vibration in solid	B1		
(ii)	long way apart in gas to very close or touching	B1		[2] Total [6]

3a) The (rapidly moving) air molecules bombard the dust particles ✓① (Because at any one moment the bombardment is not exactly even) a net force is exerted on the dust particle ✓① (which causes jiggling Brownian motion)

Because of the small mass of the particles this is enough to keep them aloft. ✓①.

b) $P_1V_1 = P_2V_2$ ✓① $\Rightarrow P_2 = P_1\frac{V_1}{V_2} = 2.0\times10^5\ Pa \times \frac{80\ cm^3}{25\ cm^3}$ ✓①

$= 6.4 \times 10^5\ Pa$ ✓①.

(or equivalent method)

4	(a)	Some have extra/more energy than others	B1	
		most energetic leave surface/ break liquid bonds etc	B2	M2
	(b)	evaporation occurs strictly at the surface/at all temperature	B1	
		boiling occurs throughout liquid/ at one temperature (at normal at. pr.)/100°C	B1	2
	(c)	energy supplied = Wt /60 x 120	C1	
		sp.latent heat = energy/mass evaporated or 60 x 120/3.2	C1	
		value is 2250 J/g	A1	3
				[7]
5	(a) (i)	nitrogen	M1	
	(ii)	copper-solid-molecules very tightly bonded together so separate little	B1	
		water – liquid – molecules less tightly bonded/still small separation	B1	
		nitrogen – gas – molecules "free" and not bonded so separate most	B1	M3
		(N.B. accept 2 bonding statements for 2 marks. 1 separation statement for 1 mark)		
	(b) (i)	size of movement/change in length of liquid column per degree	B1	
	(ii)	change in length (of liquid column) same for all degrees	B1	2
				[5]

6	a	junction of two metals, other ends to meter/alternative arrangements	C1	
		two metals named, meter labelled	2 A1	2
	b(i)	meter calibrated in degrees or read value and use calibration chart	B1	
	(ii)	change in temp. causes change in voltage/current	2 B1	2
	c	high (low) temperatures	B1	
		rapidly changing temperatures (or low thermal capacity)	B1	
		any valid physical reason e.g. distance reading needed, small site etc	2 B1	M2*
			QT	6

7	(a)	start temp. and final temp. or change in temperature	B1	
		mass of iron	B1	
		time heater on	B1	3
	(b)	P x t, VIt or in words	B1	
		= m x shc x cit or words	B1	2
	(c) (i)	heat lost to surroundings/air	B1	
	(ii)	add lagging/insulate	B1	2
				[7]