

- 1 (a) any two from:
 at surface / not within liquid (if other way round must be explicit) B1
 at any temperature / not at boiling point (if other way round must be explicit) B1 [2]
 (evaporation) causes cooling
 boiling requires a heat source
 bubbles rising
- (b) (i) viable heat source clearly described e.g. electrical/immersion heater B1
 appropriate readings e.g. V , I , t or P & t or joulemeter readings B1 [2]
 OR
 combustion heater but only with some mention of amount of fuel used B1
 correct measurement of amount of fuel used B1
- (ii) viable mass measuring device clearly described B1
 e.g. (top pan) balance/scale
 appropriate readings B1 [2]
 e.g. mass of water before and after / change of mass of water
 OR
 measuring cylinder B1
volume of water before and after / change of volume of water B1
- [Total: 6]

- 2 (a) any two of:
 boiling throughout liquid (evaporation at surface),
 boiling at one temperature (evaporation at any / all temperature / below boiling point),
 boiling not affected by draught/area (evaporation is),
 boiling produces bubbles (evaporation does not). B2
- (b) (thermal energy) does work against intermolecular forces / breaks bonds B1
 molecules separated/moved apart OR becomes PE B1
- (c) apparatus: e.g. kettle AND balance / scales OR steam condensing in water with
 measuring cylinder / scales AND thermometer B1
 two masses determined OR volume/mass condensed B1
 determine energy input: e.g. VIt or Pt or $mc\Delta T$ B1
 $(l_e =)Q/m$ B1 [8]

- 3 (a) (i) (gravitational) potential energy to kinetic energy B1
- (ii) chemical energy to (gravitational) potential energy B1
- reference in (i) or (ii) to heat/thermal/internal energy produced OR work done against air resistance or friction B1
- (b) (i) (K.E. =) $\frac{1}{2}mv^2$ OR $0.5 \times 940 \times 16^2$ C1
 $1.2 \times 10^5 \text{ J}$ A
- (ii) in words or symbols $Q = mc\theta$ OR $\theta = Q/mc$ C1
 $1.203 \times 10^5 = 4.5 \times 520 \times \theta$ OR $\theta = 1.203 \times 10^5 / (4.5 \times 520)$ C1
 51°C or K A1

[Total: 8]

- 4 (a) matt black B1
- (b) (i) L down and R up, equal amounts (by eye) B1
- (ii) on black side or on left (more) energy / heat absorbed OR greater temp rise OR heats up quicker B1
- on black side or on left greater expansion of air / greater pressure of air B1 [4]

- 5 (a) (i) good conductor (of heat) (ignore electricity) B1
- (ii) black is good absorber/bad reflector (ignore emitter) B1
- (iii) reduce heat lost/conducted away (from pipes/sheet) NOT prevents heat loss o.w.t.t.e. B1
- (iv) air heated OR glass reduces/prevents convection OR greenhouse effect OR reference to far and near I.R. OR glass prevents warm air being blown away OR traps air Ignore traps heat B1
- (b) 38 – 16 OR 22 C1
 $mc\theta$ OR $250 \times 4200 \times \text{his } 22$ C1
 2.31×10^7 (J) e.c.f from previous line C1
 9.24×10^7 J OR e.c.f from previous line $\times 4$ correctly evaluated A1
 No unit penalty if J seen anywhere in (b) clearly applied to an energy

[Total: 8]

- 6 (a) Total penalty for use of 'particles' rather than 'molecules' is 1 mark.
- (i) idea of some molecules gaining more KE B1
 mols overcome attractive forces OR mols break free of surface B1
- (ii) greater area B1
 more mols escape (in given time) B1
- (iii) increase temperature / supply more heat / make hotter)
 blow air across surface, or equiv.) any 2 B1 + B1
 reduce humidity)
 decrease pressure)
- (b) water evaporates from cloth / water OR faster / more energetic molecules evaporate)
 less energetic mols left behind)
 energy to evaporate taken from milk) any 3 B1 \times 3
 evaporation produces cooling)
 idea of cloth always being damp by soaking up water) [9]

7	(a)	(i)	random high speed (between collisions)		B1 B1
		(ii)	hit walls many hits/unit area OR hit hard OR large force OR high energy OR many hits/s OR hit very often		B1 B1
	(b)		particles vibrate (more) OR electrons gain energy particle to particle transfer OR flow of free electrons		B1 B1
	(c)		75×3200 OR ml 240 000 J OR 240 kJ OR 2.4×10^5 J		C1 A

[Total: 8]

8	(a)		(horizontal) force allow F	F	B1
			distance (travelled from A to B) condone "perpendicular" allow D OR d OR S	F	B1
	(b)		goes faster OR less time	F	B1
			accelerates	C	B1
	(c)	(i)	2 nd person (however expressed)	F	B1
		(ii)	more work/energy OR bigger force OR pulls harder	F	B1
			smaller time OR greater speed ("more work/second" gets B1, B1)	C	<u>B1</u> <u>7</u>
