01. 0625_s23_ms_41 Q: 3

Question	Answer	Marks
(a)	heated / hot(ter) / warm(er) air is less dense **OR** cool(er) air is more dense	**B1**
	heated / hot(ter) / warm(er) air rises (to ceiling displacing cooler air) **OR** cool(er) air falls (displaced by warm(er) air)	**B1**
(b)(i)	speed / velocity (of particles) increases **OR** (they) move faster	**B1**
(b)(ii)	(higher temperature means) particles collide (with rubber) harder / with more force / with greater momentum (change)	**B1**
	(larger volume means) particles collide (with rubber) less frequently **OR** (larger volume means) larger (surface) area (for particle collisions)	**B1**
	effect of larger volume cancels effect of increased temperature / owtte **OR** the effect of larger area cancels the effect of larger force / owtte **OR** $P = F / A$ so the two changes cancel each other / owtte	**B1**

02. 0625_s23_ms_41 Q: 4

Question	Answer	Marks
(a)(i)	$c = (\Delta)E / m\Delta\theta$ **OR** $(\Delta E =)\ mc\Delta\theta$	**B1**
	$(\Delta\theta =)$ 21.5 – 19 OR $(\Delta\theta =)$ 2.5 (°C)	**B1**
	$(\Delta E =)$ 0.6(0) × 4200 × 2.5 **OR** $(\Delta E =)$ 0.6(0) × 4200 × {21.5 – 19}	**B1**
(a)(ii)	(maximum possible efficiency =) 3.1% or 0.031	**A4**
	$E = Pt$ **OR** $(E =)\ Pt$ **OR** $(E =)$ 13 × 500 **OR** $(E =)$ 6500	C1
	(useful energy output =) 6500 – 6300 **OR** (useful energy output =) 200	C1
	efficiency = useful energy (output) / total energy (input) (× 100%) **OR** (efficiency =) useful energy (output) / total energy (input) (× 100%) **OR** (efficiency =) {6500 – 6300} / 6500 **OR** (efficiency =) 200 / 6500 (× 100%)	C1
	OR	
	$P = E/t$ **OR** $(P =)$ E / t **OR** $(P =)$ 6 300 / 500 OR $(P =)$ 12.6 (W)	(C1)
	(useful power output =) total power (output) – wasted power (output) **OR** (useful power output =) 13 – {6300 / 500} **OR** (useful power output =) 13–12.6	(C1)
	efficiency = useful power (output) / total power (input) (× 100%) **OR** (efficiency =) useful power (output) / total power (input) (× 100%) **OR** (efficiency =) 0.4 / 13 (× 100%)	(C1)
(b)	any **one** from: • temperature change is an underestimate (due to thermal energy losses) • (thermal energy is) transferred from the water (to air / beaker / bench) • energy (other than light) transferred in lamp (filament / glass / internal structure) • (some) water evaporates	**B1**

03. 0625_s23_ms_43 Q: 3

Question	Answer	Marks
(a)(i)	(greatest) gas	**B1**
	(least) solid	**B1**
(a)(ii)	any **three** from: • (solids) particles vibrate • (gases) particles move freely • (solids) particles in fixed / close positions • (gases) particles randomly arranged (in container) / wide separation • (gas) particles move quickly	**B3**
(b)(i)	(specific heat capacity is the) energy required to raise 1 kg / unit mass by 1 °C / 1 K / 1 kelvin / unit temperature	**A2**
	energy required per unit mass / 1 kg **OR** energy required per unit temperature / 1 °C increase / 1 K increase / 1 kelvin increase	**C1**
(b)(ii)	time	**B1**
	mass	**B1**
	initial temperature **AND** final temperature	**B1**

04. 0625_w23_ms_42 Q: 2

Question	Answer	Marks
(a)(i)	evaporation	**B1**
(a)(ii)	air is drier	**B1**
	because water vapour has condensed / turned back to liquid in the condenser	**B1**
(b)(i)	gravitational (force) **OR** weight	**B1**
(b)(ii)	(force is) perpendicular to the motion (of the clothes)	**B1**
(c)	uses (solar / wind) energy which is renewable **OR** energy (re)sources not used to generate electricity **OR** greenhouse gases not produced **OR** does not use (fossil) fuels	**B1**

05. 0625_w23_ms_42 Q: 4

Question	Answer	Marks
(a)(i)	*any three from:* • increase in the (average) KE / speed of air particles • more frequent collisions of (air) particles (with bottle) • more forceful collisions of (air) particles (with bottle) • greater force per unit area gives greater pressure • volume unchanged and so pressure increases	**B3**
(a)(ii)	(pressure decreases as) air (particles) escape from the bottle / into the air	**B1**
	until pressure (inside the bottle) is same as (air) pressure outside the bottle **OR** until pressure (inside the bottle) is same as atmospheric pressure	**B1**
(b)	1.5×10^4 J	**A2**
	$c = (\Delta)E / m\Delta\theta$ $(\Delta E =)\ mc\Delta\theta$ OR $(\Delta E =)\ 0.18 \times 4200 \times 20$	C1
(c)	3900 Pa	**A2**
	$(\Delta p =)\ \rho g(\Delta)h$ OR $(\Delta p =)\ 1.0 \times 10^3 \times 9.8 \times 0.4$ OR $(\Delta p =)\ 1.0 \times 10^3 \times 9.8 \times 40$ OR $(\Delta p =)\ 3.9 \times 10^N$	C1

06. 0625_m22_ms_42 Q: 3

Question	Answer	Marks
(a)	*Any two from:* • (Amount of water in the pool decreases) as water evaporates / becomes water vapour / gas • The (more) energetic molecules escape OR fast(er) molecules escape OR molecules with more (kinetic) energy escape • From the <u>surface</u> of the water	**B2**
(b)	lower temperatures / cold(er) day — OR — less windy weather	**B1**
	produces smaller pool more slowly because rate of evaporation decreases with decreasing temperature — OR — produces smaller pool more slowly as a draught over surface removes water vapour enabling faster rate of evaporation	**B1**
(c)	*Any three from:* • (thermal) energy in the skin / body transferred to (molecules of) sweat • These molecules (have enough KE to) escape from the skin / become water vapour • Leaving behind molecules with lower energy • Which leaves the skin / body at a lower temperature	**B3**

07. 0625_s22_ms_41 Q: 4

Question	Answer	Marks
(a)(i)	two / three wires of at least two different metals	**B1**
	one junction in sulfur	**B1**
	the other junction in ice-water mixture / at room temperature **and** one of the wires must be from the first junction	**B1**
	labelled voltmeter / voltmeter symbol correctly connected	**B1**

Question	Answer	Marks
(a)(ii)	measure e.m.f.	**B1**
	how to find temperature from e.m.f. (e.g. use calibration graph **or** calculation **or** table)	**B1**
(b)	measures high temperatures / wires do not melt / rapid response / robust / small heat capacity / electrical output / (can be) remote from observer / direct input to computer	**B1**

08. 0625_s22_ms_42 Q: 4

Question	Answer	Marks
(a)	statement: bore of constant (cross sectional) area	**B1**
	explanation: idea of same movement / change in length of liquid / thread AND for same increase in volume / expansion (of liquid)	**B1**
	statement: (liquid has) constant thermal expansion	**B1**
	explanation: liquid moves same distance for each °C temperature rise	**B1**
(b)	heat capacity / it is small	**B1**
	only uses / needs a small amount of (thermal) energy (to raise its temperature)	**B1**
(c)	36 J	**A3**
	(E =) $C\Delta T$ in any form	C1
	(E =) 0.11 × (345 – 20) OR (ΔT =) 325 (°C)	C1

09. 0625_s22_ms_43 Q: 5

Question	Answer	Marks
(a)	energy required to raise the temperature of 1 kg / 1 g / unit mass of a substance by 1 °C / unit temperature	**A2**
	energy required to raise the temperature of a substance by 1 °C	C1
(b)(i)	0.50 kg	**A2**
	$\rho = m/V$ in any form	C1
(b)(ii)	190 000J / 1.9 × 10^5 J / 190 kJ	**A5**
	(E=) $mc\Delta T$ in any form	C1
	(E=) mL in any form	C1
	Use of c = 4200 (J / kg °C) AND ΔT = 5	C1
	Use of c = 2100 AND ΔT = 18	C1

10. 0625_w22_ms_41 Q: 4

Question	Answer	Marks
(a)(i)	240 N	**A2**
	$F = pA$ in any form **or** $1.0 \times 10^5 \times 2.4 \times 10^{-3}$	C1
(a)(ii)	5.0 J	**A2**
	WD = $Fx_{\parallel}$ **or** 240 × 0.021	C1
(b)	(–)3.5×10^3 J	**A2**
	$E = C\Delta T$ in any form **or** 89 × (21 – (–18) **or** 89 × (3) **or** 89 × 39	C1
(c)		**B3**
	(as the volume decreases) the particles collide more often	B1
	(as the temperature decreases) the particles collide less violently	B1
	two effects cancel (to leave the pressure unchanged) **or** particles collide with walls / piston / cylinder	B1
(d)		**B2**
	(attractive) forces between (any two) particles large(r than in gases)	B1
	particles close(r) together (than gas particles) **or** particles already touching	B1

11. 0625_w22_ms_43 Q: 4

Question	Answer	Marks
(a)(i)	any **one** from: • volume (of liquid) • length (of thread / liquid in tube).	**B1**
(a)(ii)	more **OR** greater (sensitivity)	**M1**
	volume of liquid / length of thread increases more per °C / unit temperature (because greater volume of liquid present) **OR** (more liquid to expand so) gives a larger change in the level of the liquid per °C / unit temperature	**A1**
(a)(iii)	longer (capillary) tube	**M1**
	liquid can expand further so to a higher temperature	**A1**
	OR	
	smaller (volume) bulb	**(M1)**
	less liquid so liquid expands less / lower rise per °C	**(A1)**
	OR	
	larger diameter / wider capillary tube	**(M1)**
	lower increase in level for each °C	**(A1)**
	OR	
	replace liquid with a liquid with lower expansivity	**(M1)**
	liquid expands less for each °C	**(A1)**
(b)	e.m.f.	**B1**

12. 0625_w22_ms_43 Q: 5

Question	Answer	Marks
(a)	energy from the Sun transfers to / is absorbed by (water) molecules, (so KE of (water) molecules increases)	**B1**
	molecules with high(er) energy / KE / fast(er) moving molecules escape (from the surface)	**B1**
	wind removes molecules when they have left the surface (so they do not re-enter the liquid)	**B1**
	any **one** from: • wind increases the rate of evaporation • (absorption of) energy from the Sun increases the rate of evaporation • least / less water evaporates / lower rate of evaporation from dish C • most / more water evaporates / higher rate of evaporation from dish B	**B1**
(b)	energy to change 1 kg / unit mass from liquid to gas / gas to liquid (without changing its temperature)	**A2**
	energy to change from liquid to gas / gas to liquid **OR** energy to change state of 1 kg	C1
(c)	A: temperature (of solid / ice) increases **AND** C: temperature (of liquid / water) increases	**B1**
	B: solid / ice changes to liquid / water **OR** solid / ice melts (at constant temperature)	**B1**
	D: liquid / water changes to gas / steam **OR** liquid / water boils (at constant temperature)	**B1**

13. 0625_s21_ms_41 Q: 5

	Answer	Mark
(a)	molecules / they speed up **or** gain kinetic energy	**B1**
	molecules move further apart **or** push others away	**B1**
(b)	forces between liquid molecules weak(er than in solids)	**B1**
	less energy / work done to separate molecules **or** greater separation for same work done / same increase in energy	**B1**
(c)(i)	greater sensitivity	**B1**
	volume increase (of liquid in second thermometer) is greater **or** liquid moves a greater distance (for the same temperature increase)	**B1**
(c)(ii)	smaller range **and** either of: • smaller temperature increase for liquid / meniscus to reach end of tube • expands more / greater sensitivity **and** tube of same length	**B1**
(d)(i)	statement of <u>problem</u> (e.g. bridges buckle (in hot weather))	**B1**
(d)(ii)	suggested solution to problem stated in **5(d)(i)** (e.g. allow gaps at the ends of the bridge)	**B1**
	more detail (e.g. as the bridge expands the gaps close)	**B1**

14. 0625_s21_ms_42 Q: 4

	Answer	Mark
(a)(i)	random / haphazard / zig-zag / irregular	B1
(a)(ii)	(liquid / water) molecules move fast OR (pollen) particles massive	B1
	collide / bombard	B1
	uneven collisions / collisions from different directions (cause random movement) OR (liquid / water) molecules move randomly	B1
(b)(i)	cooling	B1
	(thermal) energy used / needed to evaporate (ethanol) / overcome attractive forces(between molecules / particles)	B1
	thermal energy taken from skin / patient / person	B1
	alternative route for last two m.p.s	
	more / most energetic (liquid) molecules / particles escape OR less / least energetic (liquid) remain	(B1)
	less / least energetic molecules / particles linked to lower temp (of skin)	(B1)
(b)(ii)	greater / increases / faster / higher	B1

15. 0625_s21_ms_43 Q: 4

	Answer	Mark
(a)(i)	Energy transferred when 1 kg / unit mass of a substance freezes or melts	A2
	Energy transferred when a substance freezes/melts/changes state	C1
(a)(ii)	cup containing mixture of ice and water	M1
	mixture of ice and water will remain at 0 °C until all ice is melted (but temperature of water at 0 °C rises) or reverse argument OR energy needed for change of state so temperature doesn't rise until this has taken place	A1
(b)(i)	in evaporation more – energetic / faster moving molecules / molecules with high(er) kinetic energy escape (from surface)	B1
	low(er) energy / slow molecules remain OR so remaining liquid is cooler	B1
	thermal energy is taken from person to liquid (so person cools down)	B1
(b)(ii)	(great(er) / fast(er) evaporation of sweat as) wind blows fast moving molecules away OR molecules do not re-enter the liquid	B1

16. 0625_w21_ms_41 Q: 2

Question	Answer	Marks
(a)	(quantity of thermal) energy **or** energy (to increase temperature) **or** energy (transferred by heating)	**C1**
	energy to increase temperature (of an object) per degree Celsius 1 °C	**A1**
(b)(i)	(internal energy) depends on kinetic energy (of molecules)	**B1**
	kinetic energy (of molecules) decreases **or** potential energy (of molecules) decreases	**B1**
(b)(ii)	$(\Delta E =)$ $mc\Delta T$ in any form **or** $0.24 \times 4200 \times 17$	**C1**
	1.7×10^4 J	**A1**
(c)(i)	k.e. of molecules / (thermal) energy absorbed (from water / surroundings) **or** energy absorbed from (cooling) water	**B1**
	supplies latent heat **or** energy used to overcome intermolecular forces / to break bonds	**B1**
(c)(ii)	any determination of mass	**B1**
	determine change in mass (of ice) / increase in mass of water **or** dry the ice **or** ensure water is at 0 °C / equilibrium is established **or** insulate the beaker	**B1**
	use $(l_f =)$ E / m in any form	**B1**

17. 0625_w21_ms_42 Q: 5

Question	Answer	Marks
(a)	wires of 2 different metals	**B1**
	one junction clearly in each liquid	**B1**
	voltmeter / ammeter / galvanometer correctly connected	**B1**
(b)	any **two** from • expansion of liquid • expansion of solid • expansion of gas • density (of liquid) • (electrical) resistance	**B2**
(c)	any **two** from • large range • (measure) high temperatures • remote sensing • small size OR small mass • small thermal capacity • suitable for data logging • responds quickly OR measures rapidly varying temperatures OR temperature changing continuously	**B2**

18. 0625_m20_ms_42 Q: 4

(a)	(thermal) energy to change state o.w.t.t.e.	**M1**
	to melt (solid) per kg / unit mass NOT per °C	**A1**
(b)(i)	$E = mc(\Delta)T$ in any form OR $(c =)$ $E / m(\Delta)T$ OR $(c =)$ $35\,000 / (0.35 \times 24.5)$	**C1**
	$(c =)$ 4 100 J / (kg °C)	**A1**
(b)(ii)	use of 35 000	**B1**
	$E = ml$ in any form OR $(m =)$ E / l OR $35000 / 3.3 \times 10^5$	**C1**
	(m =) 0.11 kg	**A1**

19. 0625_s20_ms_41 Q: 4

(a)	<u>temperature</u> at which liquid turns into gas	**B1**
(b)(i)	(E =) $mc\Delta T$ OR $0.30 \times 4200 \times (100 - 95)$	**C1**
	6300 J	**A1**
(b)(ii)	(C =) $E / \Delta T$ OR 6300 / 84	**C1**
	75 J / °C	**A1**
(b)(iii)	molecules do work against attractive force as they evaporate	**B1**
	more energetic molecules more likely to escape	**B1**
	average energy of remaining molecules decreases	**B1**

20. 0625_s20_ms_42 Q: 3

(a)	E = mc∆T in any form OR (E =) mc∆T	**C1**
	efficiency = (energy) output / (energy) input in any form	**C1**
	$15 \times 4200 \times \Delta T = 5000 \times 3600 \times 0.2$	**C1**
	($\Delta T = 5000 \times 3600 \times 0.2 / 15 \times 4200$ =) 57 °C	**A1**
(b)	e.g. renewable OR no <u>air</u> pollution OR low running costs OR no named polluting gas OR no greenhouse effect	**M1**
	explanation that follows from advantage stated	**A1**
	e.g. expensive to install OR not available at night OR visual pollution OR needs a suitable (roof) space	**M1**
	explanation that follows from disadvantage stated	**A1**

21. 0625_s20_ms_42 Q: 4

(a)	(place) in <u>melting</u> ice	**B1**
	when bead has stopped moving OR owtte mark as lower fixed point / 0 °C	**B1**
	(place) in <u>steam</u> (above boiling water)	**B1**
	when bead has stopped moving OR owtte mark as upper fixed point / 100 °C	**B1**
(b)	bead would not be liquid owtte	**B1**
(c)(i)	thinner bore / tube OR smaller bulb OR use liquid which expands more (per unit change in temperature)	**B1**
(c)(ii)	longer tube OR larger (volume) glass bulb OR use liquid which expands less (per unit change in temperature)	**B1**
(d)	expands uniformly (with temperature) OR same distance between all degree intervals	**B1**

22. 0625_s20_ms_43 Q: 4

(a)	molecules escape from the surface of the liquid	**B1**
	more energetic / faster moving molecules escape	**B1**
	slower / less energetic molecules are left behind	**B1**
	temperature of liquid decreases because average K.E. of remaining molecules is lower	**B1**
(b)	any **two** from: air temperature increases more wind cloud stops covering the Sun	**B2**

23. 0625_w20_ms_41 Q: 4

Question	Answer	Marks
(a)	molecules close(r)	**B1**
	molecules move only small distances (between collisions) **or** do not move freely	**B1**
	molecules move in clusters **or** slide past each other	**B1**
(b)	molecules (in liquid) move faster **or** gain energy	**B1**
	molecules move apart (on average)	**B1**
(c)(i)	molecules overcome forces / gain potential energy as the liquid boils	**B1**
(c)(ii)	(m =) ρV (in any form) **or** 0.86 × 50 **or** 43 (g)	**C1**
	(l_v =) $Q \div m$ (in any form) **or** 18 000 / 43 **or** 18 000 / (0.86 × 50)	**C1**
	420 J / g **or** 4.2×10^5 J / kg	**A1**

24. 0625_w20_ms_42 Q: 4

Question	Answer	Marks
(a)	thermocouple	**B1**
(b)	(ΔT =) {1.7 / 5.4} × 100	**C1**
	(T = 31 + 20 =) 51°C	**A1**
(c)	any application involving high(er) / low(er) temperatures OR rapidly changing temperatures OR on vibrating machinery OR remote sensing OR data logging OR small areas / masses	**B1**

25. 0625_w20_ms_42 Q: 5

Question	Answer	Marks
(a)(i)	(thermal) energy (needed) to change state	M1
	of unit mass / 1 kg (of material) NOT per °C	A1
(a)(ii)	molecules must be separated OR (intermolecular) bonds must be broken / overcome	B1
	work done (against bonds) OR energy is required / needed NOT increase of KE / speed	B1
(b)	$E = ml$ in any form or ($l =$) $E \div m$ words, symbols or numbers	C1
	($m =$) 1.5 OR 1500 OR OR 3.8 – 2.3 OR 3800 – 2300	C1
	($l = 1.26 \times 10^6 \div 1.5 =$) 8.4×10^5 J / kg	A1
(c)	insulate OR apply lagging / insulation (to container)	B1
	reduction of thermal energy / heat losses	B1

26. 0625_s19_ms_41 Q: 4

(a)(i)	$E = mc\,(\Delta)T$ in any form words, symbols or numbers **OR** ($E =$) $mc\,(\Delta)T$ **OR** $0.23 \times 0.72 \times 550$	C1
	91 J	A1
(a)(ii)	1. $t = E / P$ in any form words, symbols or numbers **OR** ($t =$) E / P **or** 91 / 2.4	C1
	38 s	A1
	2. (thermal) energy is used to increase the temperature of / lost to cylinder / piston / heater / surroundings	B1
(b)(i)	it / piston moves to the right / away from heater **OR** accelerates (to right)	M1
	pressure (of gas) greater / pressure greater (on left) / resultant force to right	A1
(b)(ii)	$V_2 = p_1V_1 / p_2$ in any form **OR** ($V_2 =$) p_1V_1 / p_2 **OR** $2.9 \times 10^5 \times 1.9 \times 10^{-4} / 1.0 \times 10^5$	C1
	5.5×10^{-4} m^3	A1

27. 0625_s19_ms_41 Q: 5

(a)(i)	any **two** from: occurs throughout the liquid **OR** bubbles formed occurs at one temperature / boiling point does not produce cooling **OR** unaffected by draught / surface area / humidity	B2
(a)(ii)	(more) energetic molecules escape (from the liquid) **OR** molecules gain energy and escape **OR** molecules overcome intermolecular forces / break bonds	B1
	average speed decreases **OR** molecules with less (kinetic) energy left behind	B1
	temperature of liquid decreases	B1
	(thermal) energy conducted / gained from skin / body **OR** (thermal) energy lost by skin / body	B1
(b)	molecules touching **OR** no space between molecules	B1
	large (repulsive / intermolecular) forces (when moved closer)	B1

28. 0625_s19_ms_42 Q: 4

(a)	pressure increases	**B1**
	any **two** from : • molecules travel shorter (average) distance between collisions with <u>walls</u> NOT molecules change speed • molecules hit <u>walls</u> more often OR more collisions (per unit area) <u>with walls</u> • {greater force OR greater (rate of) change of momentum of molecules} per unit area on <u>walls</u>	**B2**
(b)	1st box **gas**	**B1**
	2nd box **solid**	**B1**

29. 0625_s19_ms_42 Q: 5

(a)(i)	boiling	**B1**
(a)(ii)	evaporation	**B1**
(b)(i)	E=mc∆T in any form OR (E=) mc∆T OR (E=) 2.7 × 900 × 18	**C1**
	44 000 (J)	**A1**
	E=Pt in any form OR (P=) E/t OR (P=) 43 740/150	**C1**
	(P=) 290 W	**A1**
(b)(ii)	lagging/insulation/named insulator (around/on block)	**M1**
	reduction of thermal energy/heat losses	**A1**

30. 0625_s19_ms_43 Q: 4

(a)	Any two from: bubbles form OR occurs throughout liquid only occurs at one temperature/boiling point does not produce cooling OR not affected by surface area / humidity / draught OR does not lower KE of molecules left in the liquid.	**B2**
(b)	*E* = *Pt* in any form OR (*E*) = 370 × 240	**C1**
	= 89 000 (J)	**A1**
	E = *mc*∆*T* in any form	**C1**
	(temperature increase =) 89 000 / {5.0 × 420} =) 42 °C	**A1**

31. 0625_w19_ms_43 Q: 5

(a)	(energy =) power x time in any form	C1
	= 3000 × 3.5 × 60	C1
	= 630 000 J	A1
(b)	(*E* =) *mc*Δ*T* in any form	C1
	m = 1700 / 1000	C1
	Δ*T* = (100–19) OR Δ*T* = 81	C1
	(*E* =) $\frac{1700}{1000}$ × 4200 × 81	C1
	= 580 000 J	A1
(c)	Efficiency = $\frac{\text{useful energy output}}{\text{total energy input}}$ OR $\frac{580000}{630000}$ (× 100)	C1
	= 0.92 OR 92%	A1

32. 0625_s18_ms_41 Q: 8

(a)	(Q =) mcΔθ **OR** 200 × 4.2 × 22	1
	18000 J	1
(b)	Q = m × L **OR** (L =) Q ÷ m **OR** 18 480 ÷ 60	1
	310 J / g	1
(c)	(Thermal) energy/heat transfers from surroundings **OR** into water	1

33. 0625_w18_ms_41 Q: 5

(a)(i)	2 different metals labelled	B1
	2 junctions between different metals	B1
	Correctly connected meter	B1
(a)(ii)	Any **two** of: Suitable for high temp measurement OR has wide range Has low value of thermal capacity OR absorbs only a small quantity of thermal energy / heat Measures temperature at a point OR small size Responds quickly Can be used for remote sensing	B2
(b)(i)	More sensitive	B1
	Thread moves further (for same expansion)	B1
(b)(ii)	More sensitive	B1
	Greater expansion / more liquid (from bulb)	B1

34. 0625_w18_ms_41 Q: 6

(a)	Any **three** from: Temperature (of liquid / water) Surface area (of liquid / water) Draught / wind / movement of air (over surface) Temperature <u>of surroundings</u> Humidity (of surrounding air)	**B3**
(b)	**Any two** from: More energetic / faster molecules escape Less energetic / slower molecules remain OR remaining water is colder Thermal energy / heat flows from body / skin to colder water (and person feels colder) OR (for one mark each) (Evaporation requires) latent heat of vaporisation Thermal energy / heat flows from body / skin	**B2**

35. 0625_w18_ms_42 Q: 4

(a)(i)	any feasible named insulating material	**B1**
	reduces thermal energy / heat loss or transfer to surroundings	**B1**
	more (calculated electrical) energy (transferred) into block **or** (it is an) insulator / poor conductor	**B1**
(a)(ii)	insulation on top of block	**B1**
(b)	(energy input = VIt = 12 × 3.8 × 600 =) 27 000 (J)	**B1**
	SHC = $E / m\Delta T$ in any form OR $E / m\Delta T$	**B1**
	(ΔT =) 55 – 25 OR 30 (°C)	**B1**
	(SHC = 27 000 / (2 × 30)) = 450 J kg^{-1} °C^{-1} OR J / (kg °C)	**B1**

36. 0625_w18_ms_43 Q: 5

(a)	power supply **and** (top-pan) balance / scales **and** stopwatch / timer / joulemeter	**B1**
	measure mass (of block) **and** initial **and** final temperature	**B1**
	reading from joulemeter **or** measure time (of heating) **and** (E =) Pt / VIt **or** $c = Pt / m\Delta T$	**B1**
	$c = Pt / m\Delta T$ **or** $c = E / m\Delta T$	**B1**
(b)(i)	energy required to increase the temperature per °C / per unit temperature increase	**B1**
(b)(ii)	(C =) $m\,c$ **or** 85 × 460	**C1**
	3.9 × 10^4 J / °C	**A1**

37. 0625_m17_ms_42 Q: 5

(a)(i)	Two of: Evaporation takes place at any temperature Evaporation takes place at the surface Evaporation takes thermal energy / heat from liquid OR Evaporation lowers temperature of liquid No bubbles (rise to surface during evaporation) Evaporation lowers temperature of liquid	**B2**
(a)(ii)	e.g. condensation / change from gas to liquid OR freezing or solidification / change from liquid to solid OR melting / change from solid to liquid OR sublimation / change from solid to gas	**B1**

(b)(i)	Point A: liquid cooling / temperature of liquid falling	**B1**
	Point B: (liquid) freezing / changing (from liquid) to solid	**B1**
	Point C: solid cooling / temperature of solid falling	**B1**
(b)(ii)	Specific heat capacity of liquid greater than specific heat capacity of solid	**B1**
	Total:	**7**

38. 0625_s17_ms_41 Q: 5

(a)	Pressure increases	**B1**
	Molecules (of gas) move faster/their kinetic energy increases/their momentum increases	**B1**
	(Molecules) collide with walls/piston more often/more frequently OR greater (rate of) change of momentum	**B1**
	(Molecules) exert greater/more force (on wall)/hit (walls) harder	**B1**
(b)	Pressure (of gas) falls **and** volume (of gas) increases	**B1**
	Initially there is a larger pressure inside than outside/atmospheric pressure OR (Piston stops when) pressure (of gas) = external/outside/atmospheric pressure	**B1**
	Total:	**6**

39. 0625_w17_ms_42 Q: 4

(a)(i)	any **one** of these six: • evaporation: at surface OR no bubbles form) pair 1 • boiling: throughout liquid OR bubbles form) • evaporation: at any temperature OR no heat needed) pair 2 • boiling: at specific temperature OR heat needed) • evaporation: affected by draught / surface area) pair 3 • boiling: not affected by draught / surface area)	**B1**
	any **one** pair of points	**B1**
(a)(ii)	(it / rate) increases AND {more molecules have enough energy to escape OR break bonds}	**B1**
(b)(i)	remains constant	**B1**
(b)(ii)	$E = m\,l$ in any form OR (E =) $m\,l$	**C1**
	P = energy / t in any form OR (P =) energy / t	**C1**
	($P = 0.095 \times 2.3 \times 10^6 / (12 \times 60)$ =) 300 W	**A1**

40. 0625_w17_ms_43 Q: 5

(a)	(quantity of internal) energy that raises temperature	**M1**
	per degree Celsius / per unit temperature change	**A1**
(b)(i)	560 / 562 / 561.6 J	**B1**
(b)(ii)	kinetic energy / potential energy / total energy (of atoms / molecules / particles)	**B1**
	kinetic added to potential energy (of atoms / molecules / particles)	**B1**
(c)	line from 100 °C **and** falling	**B1**
	falls at decreasing rate	**B1**
	levels off at labelled / approximate 22 °C	**B1**