Mark scheme

Thermal properties of matter

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

72

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	6	6	6	6	8	8	9	9	9	**72**

Question 1 [5]

1 **(a)** idea of expansion / gets bigger — B1

(b) particles have more energy / vibrate faster — B1
ignore move quickly or move faster

particles move apart / space between particles increases — B1
NOT particles expand

(c) contracts / gets smaller / shrinks — B1
IGNORE fits tightly

(d) idea of being pushed together — B1
accept move / stick together / compressed
accept pulled tight/together

[Total: 5]

Question 2 [6]

2(a)	more regular/uniform arrangement/fixed position owtte	**B1**
	separation between atoms decreases/move closer/tightly packed	**B1**
	slower moving atoms/atoms vibrate (more slowly)	**B1**
2(b)	(water) molecules gain energy (from surroundings)	**B1**
	molecules escape from a liquid (surface)	**B1**
	evaporation	**B1**
	Total:	**6**

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Question 3 [6]

3(a)	1. melting 2. boiling / evaporation 3. freezing / solidification	**B1** **B1** **B1**
3(b)	Any **three** from: (evaporation –) most energetic molecules escape from surface of liquid average KE of molecules remaining in liquid decreases temperature of liquid decreases energy transfers from water (on bench) to liquid (so water cools / freezes)	**B3**

Question 4 [6]

4(a)	molecules of solid arranged in lattice / in organised pattern / without gaps / orderly / fixed structure	**B1**
4(b)(i)	glass heated first **or** at first liquid not heated / does not expand / takes time (to heat up) **or** glass poor conductor	**B1**
	glass expands	**B1**
	capacity / volume of flask increases	**B1**
4(b)(ii)	liquid (starts to) warms up	**B1**
	liquid expands more than the solid / glass	**B1**

Question 5 [6]

5 **(a)** (m =) Pt / l **OR** $460 \times 180 / 2.3 \times 10^6$ **OR** $82\,800 / 2.3 \times 10^6$ C1

0.036 kg **OR** 36 g A1

(b) **(i)** any two from:
(surface) area
draught
temperature (of water / room)
humidity of air B2

(ii) any two from:
evaporation at any temperature / below boiling point
evaporation (only) at the surface
evaporation influenced by surface area / draught / temperature / humidity (not if given in **(b)(i)**) B2

[Total: 6]

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Question 6 [8]

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

Question 7 [8]

7 **(a)** energy/heat required to increase temperature
- of 1 kg / 1 g / unit mass (of the substance) B1
- by 1 °C / 1 K / unit temperature B1

(b) $E = mc\Delta\theta$ in any form OR ($c =$) $E \div m\Delta\theta$ C1
$E = Pt$ in any form OR 420×95 (= 39 900) C1
$\Delta\theta$ = [40.5 – 19.5] OR 21 C1
(c = 39 900÷42 =) 950 J/(kg °C) A1

(c) any two separate points from: max. B2
- lagging / insulation (around block) OR insulate (the block)
- raise temperature of block by a smaller amount OR heat for a shorter time OR use lower power heater for same time OR higher power for same temperature rise / shorter time
- polish the surface of the block OR wrap the block in shiny material OR paint (shiny) white
- reduce initial temperature of block (to below room temperature) OR raise temperature of room
- reduce draughts

[Total: 8]

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Question 8 [9]

8 **(a)** heat/energy to raise/change temperature M1
of 1 kg/g/unit mass through 1°C/1K/unit temperature A1

(b) **(i)** darker colours absorb more OR lighter/shiny colours absorb less B1

(ii) **1.** 182 B1
2. (mass of 1m^2 =) volume × density OR $D = M/V$ OR (1 ×) 0.01 × 7800 C1
78 kg A1
3. $Q = mc\theta$ B1
182 = 78 × 450 × θ (e.c.f. from **1**,**2**) C1
0.00519 °C/s OR 5.19 × 10^{-3} °C/s (e.c.f. from **1**,**2**) A1

[Total: 9]

Question 9 [9]

9(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
9(b)(i)	0.50 kg	**A2**
	$\rho = m/V$ in any form	C1
9(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

Question 10 [9]

10(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**
10(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
10(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**

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