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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Thermal Properties of Matter — Paper 1

Worked Answer Key (Multiple Choice)

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Thermal Properties of Matter — Paper 1 · Worked Answer Key

These are **Megalecture worked answers** for the topical multiple-choice compilation on **Thermal Properties of Matter (IGCSE Physics 0625, Paper 1)**. Every answer below was solved from first principles by the Megalecture team — no external mark scheme was used. Calculations use the data quoted in each question, applying $E = mc\Delta\theta$ for specific heat capacity, $E = mL$ for latent heat, the rules of thermal expansion, and the kinetic model for changes of state and evaporation. Use this key to mark your work and to see the one-line reasoning behind each correct letter. The compilation is grouped below into four parts by theme; the original exam-paper code is given for every item.

Part A · Specific Heat Capacity & Thermal-Energy Calculations

Q #	Exam reference	Answer	Brief working / reason
1	M/J 11 P11 Q18	C	E = mcΔθ = 0.25 × 4.2 × 15 = 15.75 kJ ≈ **16 kJ**. (Working in J: 0.25 × 4200 × 15 = 15 750 J.)
9	M/J 13 P12 Q18	A	Δθ = E/(mc) = 12 000 / (2.0 × 400) = **15 °C**.
21	M/J 18 P12 Q20	C	Same energy lost at the same rate, yet copper's temperature falls faster (bigger Δθ). From Δθ = E/(mc), a larger Δθ means a **smaller specific heat capacity**.
25	M/J 20 P11 Q22	B	Raising temperature raises the average kinetic energy of the particles, so the total **internal energy** increases. (Heat capacity and SHC are fixed properties, not quantities that "increase".)
31	O/N 11 P11 Q17	C	c = E/(mΔθ) = 5200 / (2.0 × 20) = **130 J/(kg °C)**.
33	O/N 12 P11 Q19	B	Less heat raises copper's temperature for the same mass and Δθ, so copper has a **lower specific heat capacity** than water.
39	O/N 13 P12 Q18	A	Δθ = E/(mc); same material so largest E/m wins. A: 200/0.1 = 2000 (largest); B 1000; C 1500; D 500. Greatest Δθ in **A**.
42	O/N 15 P11 Q17	C	m = E/(cΔθ) = 6000 / (4200 × 20) = **0.071 kg**.
45	O/N 15 P12 Q19	B	Heat lost by hot water = heat gained by cold: $m_{hot}(100-50) = 300(50-30)$. So m_{hot} = 300 × 20 / 50 = **120 g**.
50	O/N 16 P12 Q21	B	Water needs more energy per kg per °C, so water's SHC is higher → **copper has a lower specific heat capacity than water**.
54	O/N 17 P11 Q15	D	E = mcΔθ = 50 × 0.40 × 40 = **800 J** (mass in g with c in J/(g °C)).
57	O/N 18 P11 Q16	A	Δθ = 35 − 10 = 25 °C, so E = mcΔθ = **0.50 × 130 × 25**.
66	O/N 20 P12 Q19	C	

Q #	Exam reference	Answer	Brief working / reason
			Energy to raise 1.0 kg of steel by 1.0 °C is exactly $E = mc\Delta\theta$ with m = 1 and $\Delta\theta$ = 1, i.e. the **specific heat capacity of steel**.
68	O/N 21 P11 Q13	**B**	Less energy for the same mass and $\Delta\theta$ means copper stores less energy per °C → **copper has a lower specific heat capacity**.
70	O/N 21 P12 Q18	**D**	Power = 10 × 300 = 3000 W; E = Pt = 3000 × (8.0 × 3600) = 8.64×10^7 J. $\Delta\theta = E/(mc) = 8.64\times10^7/(500 \times 4200)$ = **41 °C**.

Part B · States of Matter, Changes of State & Latent Heat

Q #	Exam reference	Answer	Brief working / reason
4	M/J 12 P12 Q19	**B**	Latent heat is released while the substance solidifies — the flat plateau where the temperature holds steady. That is region **QR**.
7	M/J 12 P12 Q19	**B**	Ice warms from −10 up to 0 (rising line), then a flat plateau at 0 °C while it melts, then the water warms to +10. Only graph **B** shows a plateau at 0 °C.
8	M/J 12 P12 Q20	**C**	Melting −17, boiling 117. At −10 (above m.p.) it is **liquid**; at 110 (below b.p.) it is still **liquid** → liquid / liquid.
10	M/J 14 P11 Q20	**C**	The liquid stays liquid throughout (no freezing point reached); the near-flat region X is where the slow temperature fall is sustained by surface cooling. Of the options the only process actually happening is **evaporation only**.
12	M/J 14 P12 Q22	**A**	During both melting and boiling the temperature stays constant (energy goes into latent heat, not raising temperature) → **temperature does not change**.
13	M/J 15 P11 Q19	**B**	Liquid at 20 °C requires m.p. < 20 < b.p. A (−218/−183) is gas; C (44/280) and D (119/444) are still solid; only **B** (−39/357) satisfies −39 < 20 < 357.
14	M/J 15 P12 Q21	**D**	Energetic molecules escaping from the surface below boiling point is **evaporation**.
16	M/J 17 P11 Q21	**D**	Liquid range = b.p. − m.p. A 66; B 68; C 32; D 70. The largest range is **D** (iodine, 184 − 114 = 70).
17	M/J 17 P11 Q22	**C**	The lower flat plateau (melting of ice) occurs at 0 °C. On the labelled axis that level is **C**.
19	M/J 18 P11 Q17	**B**	"Escape of more energetic molecules from the surface of a liquid" is the definition of **evaporation**.
24	M/J 19 P12 Q22	**A**	Latent heat = energy absorbed or emitted by **unit mass during a change of state with no temperature change**.
29	M/J 22 P12 Q22	**D**	

Q #	Exam reference	Answer	Brief working / reason
			Boiling happens at one fixed temperature (throughout the liquid); evaporation happens at **any temperature** and **produces cooling**. Row **D**.
32	O/N 11 P11 Q19	A	Energy is taken in for melting (1) and boiling (2); energy is given out for condensing (3) and freezing (4). So taken in = 1 and 2, given out = 3 and 4 → row **A**.
40	O/N 13 P12 Q21	D	Energetic molecules escaping from the top surface is **evaporation**.
43	O/N 15 P11 Q18	C	Latent heat of vaporisation supplies the energy to **make molecules move apart** (separate to form vapour), with no temperature rise.
47	O/N 16 P11 Q17	B	P (gas → liquid) = condensation; Q (liquid → solid) = solidification; R (solid → liquid) = melting; S (liquid → gas) = boiling → row **B**.
48	O/N 16 P12 Q19	C	Surface particles gaining enough kinetic energy to break free and carry energy away describes **evaporation**.
49	O/N 16 P12 Q20	C	The plateau (constant temperature) is solidification; it is complete where the curve leaves the plateau and begins to fall again — at time **C**.
52	O/N 17 P11 Q13	B	On a cooling curve the flat region X–Y is the freezing plateau: **the liquid is turning to solid**.
53	O/N 17 P11 Q14	D	Both boiling and melting are heating processes: energy is **taken in** during both → row **D**.
55	O/N 18 P11 Q13	D	W (liquid → gas) = boiling; X (gas → liquid) = condensation; Y (solid → liquid) = melting; Z (liquid → solid) = freezing → row **D**.
58	O/N 18 P12 Q17	A	Water vapour in the warm air cools on the cold bottle and turns to liquid drops → **condensation**.
59	O/N 19 P11 Q21	D	Solid → liquid is **melting**.
63	O/N 20 P11 Q18	D	Statement 2 (boiling at a fixed temperature) and statement 3 (both absorb thermal energy / latent heat) are correct → **2 and 3**.
64	O/N 20 P11 Q21	C	The disc loses no material, so its mass is unchanged; the hot disc makes some of the water evaporate, so the water's mass falls → disc **no change**, water **decreases** = row **C**.
65	O/N 20 P11 Q23	C	Both melting and boiling involve the substance absorbing **latent heat** at constant temperature.
67	O/N 20 P12 Q20	C	Melting −17, boiling 117. At −10 it is liquid; at 110 it is liquid → **liquid / liquid**.

Part C · Thermal Expansion of Solids, Liquids & Gases

Q #	Exam reference	Answer	Brief working / reason
2	M/J 11 P11 Q19	B	A filling must expand and contract by the same amount as the tooth, otherwise it loosens or cracks → **expands by the same amount as the tooth**.
5	M/J 12 P12 Q20	A	For the same temperature rise, gases expand most and solids expand least → **most = gas, least = solid**.
11	M/J 14 P12 Q21	A	Heating speeds the molecules and pushes them further apart, so they hit harder — but the molecules themselves do **not** get larger. The incorrect statement is **A**.
18	M/J 17 P11 Q25	C	Hot water warms and **expands** the metal lid more than the glass, loosening it → expansion.
20	M/J 18 P11 Q19	B	On heating, the molecules stay the same size but move further apart, so **the spaces between the molecules become larger** (the solid expands).
23	M/J 19 P11 Q20	D	Holding the flask first warms the air more than the glass, so air expands more — index moves up. (P→Q then up to R fits: glass expands first, then air expands more.) Correct: **flask expands, then air expands more than the flask**.
26	M/J 20 P12 Q26	B	On heating a solid always expands: **a metal rod becomes longer** (its volume also increases).
27	M/J 21 P12 Q21	C	For the same temperature rise: gases > liquids > solids. So **liquids expand more than solids but less than gases**.
28	M/J 22 P12 Q21	D	Smallest to greatest expansion (same $\Delta\theta$) is solid → liquid → gas → row **D**.
34	O/N 12 P11 Q20	D	Hot water makes **the metal lid expand** more than the glass, so it unscrews.
36	O/N 12 P12 Q20	A	On cooling, brass contracts more than invar, so the strip bends toward the invar side → **brass contracts more than invar**.
37	O/N 13 P11 Q14	C	Heating mercury increases its internal energy and volume, so density falls — but the amount of mercury is fixed: **the mass of the mercury is constant**.
56	O/N 18 P11 Q15	D	To loosen a metal lid on a glass jar, **warm the lid only**: the metal expands more than the glass.
60	O/N 19 P11 Q22	B	Heating expands the rod: volume increases, mass unchanged, so **density decreases and volume increases**.
61	O/N 19 P11 Q23	D	In hot water both expand, but water expands much more than glass, so the level rises → **the flask expands less than the water expands**.

Part D · Evaporation, Cooling & Rate of Evaporation

Q #	Exam reference	Answer	Brief working / reason
3	M/J 12 P11 Q16	**C**	Fastest evaporation needs warmth (sunlight) and breeze. Container **C** is in the sun (not shaded) — water evaporates first.
6	M/J 12 P12 Q16	**A**	Drying is fastest when warm (sunny), windy and with large exposed area (unfolded): row **A** (sunny, windy, towel unfolded).
15	M/J 17 P11 Q18	**D**	Rate rises with temperature and surface area, so the largest area (40 cm^2) at the higher temperature (40 °C) evaporates fastest → row **D**.
22	M/J 19 P11 Q17	**D**	Insulating, lidding and polishing all reduce heat loss; **moving the thermometer closer to the heater** changes only the reading, not the rate energy is lost.
30	M/J 22 P12 Q23	**C**	Blowing air across the surface speeds evaporation by removing vapour; the change that increases the rate is **increasing the surface area** (wider beaker).
35	O/N 12 P12 Q16	**C**	A fan does not cool the air; it **increases the rate of evaporation of sweat from the skin**, which removes latent heat and feels cool.
38	O/N 13 P11 Q17	**D**	Wet skin feels cold because **the water takes heat from the body to evaporate** (latent heat of vaporisation).
41	O/N 14 P11 Q18	**B**	Fastest evaporation = large surface area and warm water → row **B** (large area, warm).
44	O/N 15 P12 Q18	**A**	The high-energy molecules escape, so the liquid's average kinetic energy is greater **before evaporation** than after. Row **A**: high-energy molecules leave; greater average KE before evaporation.
46	O/N 16 P11 Q16	**C**	The more energetic molecules escape, so the average kinetic energy of those remaining **decreases** (the liquid cools).
51	O/N 17 P11 Q12	**D**	Evaporation is increased by warmth, larger surface area and moving air, so **wind blowing across the surface** increases the rate.
62	O/N 19 P11 Q24	**B**	Temperature, surface area and air flow all affect evaporation; the wall thickness of the beaker does not → **using a beaker made of thicker glass** has no effect.
69	O/N 21 P11 Q16	**C**	Evaporation is slowed by trapping the vapour, so **putting a lid on the beaker** reduces the rate of loss.
71	O/N 21 P12 Q20	**D**	Greatest rate = highest temperature and largest surface area → row **D** (25 °C, 100 cm^2).

Note from Megalecture. These are original Megalecture worked solutions, prepared for revision use and solved independently from first principles. A handful of items (e.g. the "liquid/liquid" melting-and-boiling table and the lid-expansion questions) recur across different exam series and are answered consistently above. Always read the part heading and the diagram carefully, as the exam-paper question numbering differs from the compilation numbering used here.