Mark scheme

Conduction, convection and radiation

Physics 0625 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

69

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
6	8	10	6	6	6	7	6	7	7	**69**

Question 1 [6]

1 **(a)** conduction B1

(b) **(i)** convection B1

(ii) hot water expands OR hot water less dense B1
hot water rises (ignore anything about cold water falling) B1

(c) convection cannot occur B1
water is a poor conductor B1

[Total: 6]

Question 2 [8]

2(a)(i)	reduces heat transfer (to handle) OR wood is an insulator	**B1**
2(a)(ii)	poor / worst emitter (of heat)	**B1**
	(of) infrared / radiation	**B1**
2(a)(iii)	allows heat transfer (to water) OR (good) conductor (of heat)	**B1**
2(b)	any **four** from**:** conduction (through metal of heater) air particles gain kinetic energy / KE air particles move further apart hot air becomes less dense hot / less dense air rises OR cold / denser air falls idea of convection current	**B4**

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Question 3 [10]

3(a)	conduction from the element to the water	**B1**
	convection	**B1**
	warmer water less dense (than colder water) or ra	**B1**
	warm water rises / cool water falls	**B1**
3(b)(i)	dull black / can A	**M1**
	(dull black) better radiator / good radiator better emitter / gives out more radiant heat / emits more infra-red / loses more energy by radiation	**A1**
3(b)(ii)	Any **two** of following pairs: lag / wrap in (named) insulator / cotton wool / polystyrene reduces heat lost by conduction cover in foil reduces heat lost by radiation add lid reduces heat loss by convection / evaporation	**B4**

Question 4 [6]

4(a)	(tarmac / it) absorbs infrared radiation (emitted from the Sun)	**A2**
	(tarmac / it) absorbs radiation / infrared (emitted from the Sun)	C1
4(b)	conduction	**B1**
4(c)	convection	**B1**
4(d)	*any **two** from:* 1 black / tarmac is a better absorber (of radiation) than air 2 tarmac is a poor emitter (at low / this temperature) 3 thin layer of tarmac / very large volume / column of air above road	**B2**

Question 5 [6]

5(a)	any **three** from: • (metals contain) delocalised / free / mobile electrons • (delocalised electrons) gain energy (from lattice vibrations of the atoms nearest to the hot water) • (delocalised) electrons move through the metal (lattice) • collisions between the (delocalised) electrons and (remote) ions / atoms (transfers thermal energy to all parts of the metal container)	**B3**
5(b)	no delocalised / free electrons	**B1**
5(c)	particles are further / far apart	**B1**
	fewer particle collisions (to transfer energy) **OR** no lattice vibrations (to transfer energy)	**B1**

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Question 6 [6]

6(a)	any mention of radiation/infra-red radiation wrt silvered surfaces	B1
	silvered surfaces are poor emitters / poor absorbers / (good) reflectors	B1
	glass is a poor conductor OR glass reduces thermal energy / heat gain by conduction	B1
	vacuum prevents thermal energy / heat gain by conduction OR convection	B1
	stopper reduces thermal energy / heat gain by convection	B1
6(b)	any suitable insulator e.g. cork, plastic, rubber	B1

Question 7 [7]

7(a)	air good insulator / poor conductor	B1
	holder / it stops / reduces conduction OR no / less thermal energy conducted (to hand)	B1
	temperature (of outside of holder) lower (than cup) OR less energy to skin / hand / person	B1
7(b)	(put a) lid / cover (on cup)	B1
	mention of convection	B1
	less / no convection (from surface)	B1
	alternative route for last 2 m.p.s	
	mention of evaporation	(B1)
	less / no evaporation (from surface / container)	(B1)
7(c)	radiation	B1

Question 8 [6]

8 **(a)** (nuclear) fusion B1 [1]

(b) **(i)** smaller (surface) area
(accept thinner, narrower(at top), ignore reference to lid) B1 [1]

(ii) apparatus: black object, white object, thermometer(s)/ball-bearing with wax/level of water in vessel B1

source of heat e.g. Sun/radiant heater (condone light bulb/Bunsen burner) B1

action: (fill cans with water and) measure temperature rise **or** wax melts **or** compare volumes of water B1

observation: water in black can (better absorber) has greater temperature increase / wax melts first / less water
note: emission experiment gains max. 2 B1 [4]

[Total: 6]

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Question 9 [7]

9(a)	electrons mentioned	**B1**
	electrons travel (a great distance) through the metal **or** (vibrating) atoms hit (free) electrons	**B1**
	electrons hit (distant) particles **or** transfer energy (to distant atoms)	**B1**
9(b)	shiny surfaces are poor emitters (of radiation)	**B1**
	infrared / radiation / mentioned	**B1**
	less energy lost **or** lost energy does not need to be supplied	**B1**
9(c)	less thermal energy emitted **or** less space for energy to be lost	**B1**

Question 10 [7]

10	**MP1**	**apparatus:** thermometer and stopwatch	**1**
	MP2	**method:** measure independent variable measure initial and final temperatures measure time	**1**
	MP3	repeat for new value of independent variable	**1**
	MP4	**control variable:** one (explicitly stated) from: volume of water, initial temperature	**1**
	MP5	**table:** MUST be appropriate for method with: columns, with correct units, for independent and dependent variables any other quantity mentioned must have correct units	**1**
	MP6	**analysis:** compare readings in the table to see if change in insulation thickness produces change in (rate of) temperature change (owtte), plot line graph (with axes specified)	**1**
	MP7	**additional point** (one from)**:** at least 5 sets of data taken, repeat for each value of independent variable and take average correct description of how to calculate rate of cooling from results	**1**

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