

The transfer of energy by heating processes

Mark scheme

1. (a) (i) silvered surfaces 1
more than the correct number of ticks in a row negates the mark
 radiation 1
 plastic cap
 conduction, convection (both required)

	conduction	convection	radiation
vacuum	✓	✓	
silvered surfaces			✓
plastic cap	✓	✓	

(1)

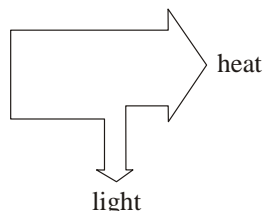
(1)

- (ii) any mention of air or any other substance in a vacuum scores zero
 because there are no particles in a vacuum 1
accept atoms / molecules for particles
accept vacuum is empty space
accept there is nothing in a vacuum
accept there is no air / gas in the vacuum
 conduction **and** convection need particles / medium
*need reference to both conduction **and** convection*
accept correct descriptions

- (b) (i) less heat lost (to air above the heater) 1
*do **not** accept **no** heat lost*
 light shiny surfaces are poor emitters (of radiation) 1
accept radiators for emitters
references to reflection are neutral

or dull, matt surfaces are good emitters (of radiation)
*do **not** credit answers which infer reflection from the underside of the hood*
ignore correct reference to absorption

- (ii) correct diagram drawn with one output arrow narrower than the other 1
ignore input
 arrows correctly labelled with energy form, eg 1



flow charts score zero

- (iii) energy cannot be destroyed 1
accept (principle of) conservation of energy
*do **not** accept because energy cannot be lost without clarification*

[9]

2.	(a)	(i)	as a source of thermal <u>radiation</u> <i>accept heat for thermal radiation</i> <i>accept to act as the Sun</i> <i>do not accept sunlight alone</i>	1
		(ii)	any one from: <ul style="list-style-type: none"> • volume of water <i>accept amount for volume</i> • distance between lamp and boiling tube • initial / starting temperature of water • same room temperature <i>do not accept time or same insulation material</i>	1
		(iii)	any one from: <ul style="list-style-type: none"> • greater sensitivity / precision <i>do not accept more reliable (negates mark)</i> • could link to a computer for (automatic) data analysis • could take more frequent readings • reduces instrument reading error <i>accept more accurate</i> <i>do not accept easier to use on its own</i> 	1
	(b)	(i)	acts as a control <i>accept to be able to make a comparison</i> <i>accept to see the difference</i> <i>do not accept 'to make it a fair test' OWTTE on its own</i>	1
		(ii)	(plastic) <u>foam</u> and aluminium foil	1
		(iii)	(aluminium) <u>foil</u> is a <u>poor</u> absorber of thermal radiation <i>accept heat / infra red for thermal radiation</i> or (aluminium) <u>foil</u> is a (good) reflector of thermal radiation <i>do not accept 'reflects sunlight' on its own</i>	1
			(plastic) <u>foam</u> traps air which is a (good) insulator <i>accept (plastic) foam is a poor conductor / (good) insulator</i> <i>do not accept 'the material' is a good insulator / poor conductor</i>	1
	(c)		particles vibrate with a bigger /stronger amplitude / faster / with more (kinetic) energy <i>accept particles vibrate more</i> <i>do not accept <u>start</u> to vibrate only</i>	1
			energy transferred by <u>collisions</u> with other particles <i>do not accept answers in terms of free/mobile electrons</i>	1

[9]

3. (a) conduction *do not accept conductor* 1
- (b) the freezer *both parts needed*
greater temperature difference (between freezer and room) 1
do not accept because it is the coldest
- (c) any **two** from: 2
- poor absorber of heat / radiation
accept does not absorb heat poor emitter of heat / radiation is neutral
 - reflects heat / radiation (from room away from fridge-freezer)
 - reduces heat transfer into the fridge-freezer
 - reduces power consumption of fridge-freezer
do not accept it is a bad conductor / good insulator
- [4]
4. (a) (i) radiation **or** infra red 1
do not accept rays
do not accept waves
accept electromagnetic waves
- (ii) good absorber (of heat) 1
to absorb heat (**or** infrared)
do not accept 'attract' or 'capture' or soak
- (iii) reduce heat loss (from the panel) 1
accept (good) (heat) insulator
accept stop or reduce conduction
accept stop or reduce convection
accept traps heat
accept keeps water hot
- (iv) to reflect (back into the panel) heat **or** infrared **or** Sun's energy 1
do not accept 'bouncing'
do not accept reflect Sun
do not accept reflect sunlight or sun's rays
- radiated **or** given out by the (black) pipe 1
accept back to pipe
accept reduce heat loss for 1 mark
accept reduce heat loss by radiation for 2 marks
accept stop heat loss by radiation for 1 mark
- (b) any **two** points from: 2
- use of a renewable energy resource
 - conservation of fuels (**or** named fuel)
 - produces no (atmospheric)
 - pollution (**or** named pollutant)
accept any reference to reduced or stopped use of fuel
do not accept 'fewer power stations' unless qualified
- [7]

5.	<p>(a) convection air is heated by the burner / particles gain energy air expands / particles move about more / particles move faster air becomes less dense / particles are more spread out air rises / particles rise - <i>not</i> heat rises air from C moves into the heater / particles from C move into the heater to replace it / them <i>any four for 1 mark each</i></p> <p>(b) (i) radiation <i>for one mark</i></p> <p>(ii) black surface radiates / emits well (allow absorbs and emits well) (allow comparison with shiny /white surfaces) large surface area needed high temperature (of the lumps) <i>any one for 1 mark</i></p>	<p>4</p> <p>1</p> <p>1</p>	[6]
6.	<p>(a) length of pipe diameter of the pipe time <i>each for 1 mark</i></p> <p>(b) convected } from boiler to radiator by water } conducted through steel radiated through air <i>each for 1 mark</i></p>	<p>3</p> <p>4</p>	[7]