Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(i)	• Use of $P = VI$ (1) • $P = 1900$ W (1.9 kW) (1)	Example of calculation $P = 230\text{ V} \times 8.20\text{ A} = 1890\text{ W}$	2
(a)(ii)	• Use of $\Delta E = mc\Delta\vartheta$ • Use of $P = \frac{\Delta E}{\Delta t}$ (1) • $\Delta t = 112$ s or 113 s [106 s or 107 s if show that value used] (1) ECF from (a)(i) (1)	Example of calculation $\Delta E = 0.655\text{ kg} \times 4190\text{ J kg}^{-1}\text{K}^{-1} \times (100 - 22.5)\text{K}$ $\Delta E = 2.13 \times 10^5\text{ J}$ $\Delta t = \frac{2.13 \times 10^5\text{J}}{1890\text{ W}} = 112.5\text{ s}$	3

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(i)	• After a short time of boiling in the flask, all the apparatus would be at 100 °C. **Or** so energy is not being used to heat up the flask **Or** so steam won't condense in the flask (1)		1
(b)(ii)	• Use of $\Delta E = mL$ (1) • Use of $P = \frac{\Delta E}{\Delta t}$ (1) • 1720 W (1.72 kW) (1)	Example of calculation $\frac{\Delta m}{\Delta t} = \frac{95 \times 10^{-3}\text{ kg}}{125\text{ s}}$ $= 7.6 \times 10^{-4}\text{ kg s}^{-1}$ $\frac{\Delta E}{\Delta t} = 7.6 \times 10^{-4}\text{ kg s}^{-1} \times 2.26 \times 10^6\text{J kg}^{-1}$ $P = 1720\text{ J s}^{-1}$	3

(b)(iii)	• Comparison of answer to (a)(i) with answer to (b)(ii) (1) • Not all of the energy from the heater is used to turn water from liquid state into vapour (1) **Or** energy is being used to heat the heat exchanger (1) **Or** not all the steam condenses in the heat exchanger • Some energy is transferred to the surroundings	e.g. rate at which thermal energy is supplied to the water in the flask is greater than rate at which thermal energy is removed from the water in the heat exchanger. If answer for (b)(ii) is bigger than 2 kW,1 mark for correct comparison can be scored.	3

Q2.

Question Number	Answer	Mark
(a)	Oscillations/vibrations (of molecules) parallel to direction of propagation (1) **Or** oscillations parallel to direction of wave travel **Or** oscillations parallel to direction of energy transfer Produces compressions and rarefactions (1)	2
(b)	Otherwise there wouldn't be a way of telling which bit of reflected sound originated with which bit of emitted sound **Or** so one returns before one emitted (1)	1
(ci)	time (= 1÷16 Hz) = 0.063 (s) (at least 2 sf) (1)	1
(cii)	Use of factor of 2 (1) Use of $v = s/t$ (1) distance = 48 m (1) (Use of 'show that' value gives 46m) Example of calculation 2 × distance = 1530 m s^{-1} × 0.063 s distance = 48 m	3
(ciii)	A shorter time between clicks because the distance is shorter **Or** more frequent clicks allow rapid motion to be perceived. **Or** allow position to be determined precisely/accurately. (1)	1
(d)	Speed in air lower than speed in water (1) So wavelength in air shorter than wavelength in water **Or** pulse length in air is shorter than pulse length in water **Or** attempt at numerical comparison of wavelength or pulse length (1) So bat echolocation will detect smaller targets **Or** detect smaller differences in position (conditional on MP2) (1) (Accept 'show more detail' or 'better resolution')	3
	Total for question	11