

Assessment Schedule – 2008**Physics: Demonstrate understanding of heat transfer and nuclear physics (90184)****Evidence Statement**

Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging.
- the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

Question	Evidence	Achievement	Merit	Excellence
ONE (a)	Similarity: Both have same number of protons (OR same atomic number). Difference: Both have different numbers of neutrons. (Pu-241 has 2 more neutrons than Pu-239) (OR have different mass numbers).	¹ Correct answer for similarity or difference.	¹ Correct answers for similarity and difference.	
(b)	$241 - 94 = 147$	² Correct answer.		
(c)	The nucleus breaks up into smaller (less massive or lighter) nuclei.	¹ Correct answer.		
(d)	Fission reactions are occurring all the time in the reactor (in the fuel rods) which provide continuous heat energy for heating the water.	¹ Mentions that fission produces heat energy OR Reaction is continuous.	¹ Links fission as the source of continuous heat energy to heat the water.	
(e)	The water inside the reactor slows down the neutrons so that they can be captured by the uranium nuclei. The heat is being constantly conducted away by the water so that the core is kept at a safe temperature.	¹ Mentions water slows the neutrons OR water removes the heat.	¹ Describes either of the concepts fully AND mentions both correctly.	¹ Explains both concepts fully and correctly.
(f)	Energy per second = $mc\Delta T + mL$ = $(1\,300 \times 4\,200 \times 30) + (1\,300 \times 2\,270\,000)$ = $1.638 \times 10^8 + 2.9510 \times 10^9$ = 3.1×10^9 W	² Correct calculation of either heating or change of state.	² Correct method and data substitution for heating and change of state but with wrong answer.	² Correct working and answer.
TWO (a)	$x = 94, y = 234$	² Correct answers.		
(b)	$E = Pt = 1.4 \times 365 \times 24 \times 60 \times 60$ = 44 150 400 = 4.42×10^7 J	² Correct data and process but wrong answer.	² Correct working and answer.	

(c)	A dull black surface absorbs and emits radiation more rapidly than other colours.	¹ General statement of black being a good absorber / good emitter of heat / good radiator.	¹ Correct answer. (MUST have both absorber and radiator)	
(d)	$Q = mc\Delta T = 0.200 \times 2\,100 \times 35$ $= 14\,700\text{ J}$ ($= 14.7\text{ kJ}$)	² Correct formula and working but used 200 g to get 14 700 000 J (OR correct substitution but incorrect answer).	² Correct working and answer.	
(e)	<ul style="list-style-type: none"> The wool is an insulator, so it will reduce heat loss by conduction The lid will reduce heat loss by air convection (accept evaporation). 	¹ Mentions either wool is an insulator OR the lid stops heat loss.	¹ Explains one of the concepts or processes fully AND mentions both	¹ Explains both the concepts or processes fully. (No irrelevancies.)
(f)	ΔH left to heat water $= 120\,960 - (68\,000 + 10\,500)$ $= 42\,460\text{ J}$ $Q = mc\Delta T$ $\Delta T = \frac{Q}{mc} = \frac{42\,460}{0.200 \times 4\,200}$ $= 50.54^\circ\text{C}$ $= 50.5^\circ\text{C}$	² Correct answer for ΔH .	² Correct process but wrong answer.	² Correct working and answer.
	Total opportunities	Criterion 1: 6 Criterion 2: 6	Criterion 1: 5 Criterion 2: 4	Criterion 1: 2 Criterion 2: 2

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
$3 \times \text{A1}$	$2 \times \text{M1} + 3 \times \text{A1}$	$1 \times \text{E1} + 2 \times \text{M1} + 3 \times \text{A1}$
$3 \times \text{A2}$	$2 \times \text{M2} + 3 \times \text{A2}$	$1 \times \text{E2} + 2 \times \text{M2} + 3 \times \text{A2}$