Mark scheme – Work Done (H)

Question			Answer/Indicative content	Marks	Guidance
1			**B** ✓	1 (AO2.1)	
			Total	**1**	
2			**B** ✓	1 (AO 2.1)	**Examiner's Comments** Questions 14 required candidates to recall and use the equation for efficiency and for question 15, candidates had to rearrange the equation provided for kinetic energy to calculate the speed of the car. A common error that candidates made in question 15 was to use the incorrect equation: KE = 0.5 x mass x speed. Other candidates could be seen to correctly rearrange the equation but forgot to square root their answer so chose option D.  **AfL** The majority of candidates who were successful at these questions wrote their calculations by the side of each question.
			Total	**1**	
3			**B** ✓	**1 (AO2.2)**	**Examiner's Comments**  Q10 and Q11 required candidates to rearrange the equations provided to calculate the useful output energy transfer per minute, or the height of the water tank. Almost every candidate wrote out their workings by the side of the question stem and then selected the correct answer. See Exemplar 1 below. **Exemplar 1**

					11 A pump lifts 500 kg of water to a water tank at the top of a building. The water gains 240 000 J of gravitational potential energy. The gravitational field strength is 10 N/kg. Use the equation: Potential energy = Mass × Height × Gravitational field strength Calculate the height of the water tank. $\frac{240000}{500 \times 10}$ A 4.8 m B 48 m C 240 m D 480 m Your answer B [1]
			Total	**1**	
4			Re-arrange and substitute into WD = F × D: 217 000 / 6 500 (1) 33.4 (m) (1)	2	
			Total	**2**	
5			Energy for oil is 672 000 (J) (1) Energy for water is 1 680 000 (J) (1) Recall P=E/t (1) Calculation to show: 672 000 / 400 = 1680 AND 1680000 / 1000 = 1680 (1)	4	
			Total	**4**	
6			Idea there is fixed energy in system / can't be (more than) 100% efficient (1) Idea that extra energy is heeded for this to happen (1)	2	
			Total	**2**	
7		i	AWARD **ALL** CANDIDATES 2 MARKS	**2** (AO1 × 2.1) (AO1 × 1.2)	**Examiner's Comments** We have adjusted the mark scheme to allow for a typo within this question.
		ii	KE transferred to thermal energy / heat in brakes / surroundings / AW ✓✓ **OR**	**2** (AO1.1) (AO1.2)	

			(KE of car) is reduced / transferred ✓ Brakes gain / absorb thermal energy / heat ✓		**ALLOW** surroundings gain thermal energy / heat dissipated to surroundings **IGNORE** just brakes get hot **Examiner's Comments** The majority of candidates knew that the kinetic energy store would decrease or be transferred and so were credited with one mark. Fewer candidates gained the second mark as although they referred to heat or thermal energy they did not specify that the energy was transferred to the brakes or surroundings (i.e. into a thermal energy store).
		iii	AWARD **ALL** CANDIDATES 3 MARKS	**3** (AO2 × 2.1) (AO1.2)	
			Total	**7**	
8			**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.8 (kWh) award 3 marks** Recall (Energy transferred =) power x time ✓ 0.2 × 4 ✓ (Energy =) 0.8 (kWh) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ALLOW** correct equation in any form **ALLOW** 200 x 4 or 200 x 4 x 60 x 60 or 200 x 14400 or 200 x 4 x 60 or 0.2 x 4 x 60 x 60 or 0.2 x 14400 or 0.2 x 4 x 60 for one mark **ALLOW** 800 or 2 880 000 or 2880 or 48 000 or 48 for two marks **Examiner's Comments** This question required candidates to recall the equation: energy transferred = power x time. The majority of candidates could substitute the values provided for power and time into the equation correctly and gained full credit. There was evidence that some candidates did not read the unit on the answer line carefully enough as they attempted to change kW into Watts and/or hours into minutes or seconds, and therefore scored 1 or 2 marks.
			Total	**3**	
9			**Maximum 2 marks from:** Higher speed increases braking distance ✓ **BUT** Double speed quadruples braking distance / braking distance is (directly) proportional to the speed squared AW ✓✓ **Maximum 2 marks from:** (Idea that) higher speed (car has) more KE ✓ **BUT** Double speed quadruples KE / KE	3 (AO 2.1) (AO 3.1ax2) (AO 2.1) (AO 3.1ax2)	**ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 30 (m). **ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 4×7.5 (= 30m) for 2 marks **Examiner's Comments** This question covered Assessment Objectives 2 and 3 and assessed candidates' ability to apply their knowledge of kinetic energy and braking distance as well as to interpret the graph. The majority of candidates scored 2 marks for linking a higher speed to increased kinetic energy and braking distance.

			is (directly) proportional to the speed squared / AW ✓✓		Although some candidates recognised that the relationships were linked to a 'square factor' they could not express it clearly and therefore only the more able candidates gained full credit for recognising that speed is directly proportional to kinetic energy and/or braking distance.
			Total	**3**	
10		i	(From) Chemical energy (store) ✓ (To) Thermal energy (store of the water in the kettle) ✓	2 (AO2 × 2.1)	**ALLOW** chemical energy store decreases **ALLOW** thermal energy store increases **ALLOW** heat / internal energy for thermal **IGNORE** sound/electrical energy **IGNORE** intermediate energy transfers/stores and any energy transfers/stores after thermal (store of the water)
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 138 000 (J) award 4 marks** (Recall: energy transferred =) power x time ✓ (Power = 5.0 x 230 =) 1150✓ (Time = 2 x 60 =) 120✓ (Energy transferred =) 1150 × 120 = 138 000 (J) ✓	4 (AO1.2) (AO2.1) (AO2.1) (AO2.1)	**ALLOW** equation in any form **ALLOW** ecf for incorrect power calculated **ALLOW** ecf for incorrect/no conversion of time
			Total	**6**	
11		i	(Store of) KE (in moving car) ✓ (transferred thermally) to (store of) thermal energy / heat (in brakes/pads/discs/tyres) ✓	2 (AO 2×2.1)	**Examiner's Comments** This question assessed candidates' ability to apply their knowledge of energy stores. Most candidates scored at least 1 mark for identifying either kinetic energy or thermal energy but it was generally only the more able candidates that identified both energy stores correctly.
		ii	**Any one from:** (Idea of) heat dissipated/transferred (to air) more quickly ✓ KE is reduced more quickly ✓	1 (AO 2.1)	**IGNORE** to thermal energy of road/surroundings **Examiner's Comments** It was evident that most candidates found this question very challenging, with usually only the most able gaining 1 mark.
			Total	**3**	