1 **(a) (i)** (P =) $F \div A$ OR $3.5 \times 10^4 \div 0.25$ C1
= 1.4×10^5 Pa ecf **(i)** A1

(ii) ($1.4 \times 10^5 - 1.0 \times 10^5$ =) $4(.0) \times 10^4$ Pa ecf **(ii)** B1

(iii) $P = h\rho g$ in any form OR (h =) $P \div \rho g$ OR $4.0 \times 10^4 \div (1020 \times 10)$ C1
= 3.9 m OR 4 m A1

(b) any 2 from: max. B2
- weight of block
- upward force of water (on block) / upthrust (of water on block)
- weight of cable

(c) (tension force) becomes smaller or zero B1

[Total: 8]

2 (a metre rule, tape measure, (surveyor's) laser measurer, trundle wheel
tape is too vague, accept rule(r) B1

(b) $M = \rho V$ in any form or ρV in words, symbols or numbers C1

(mass = 1.2×76.4 =) 92 kg A1

(c) mass (of air) in room decreases B1

(because) air expands / vol of air increases / density of air decreases / appropriate use of $pV = nRT$ OR pressure argument e.g. pressure would have increased (with constant volume) if mass constant B1

any ONE from: B1
some air leaves room
molecules collide harder or more (often)
molecules move faster / have more energy
molecules move further apart NOT molecules expand

[Total: 6]

3 **(a) (i)** force / pressure greater on outside surface owtte B1

(ii) $p = F / A$ in any form **OR** $(F =)\ pA$ C1
$= (1.0 \times 10^5 - 6000) \times 0.12$ C1
11280 N to at least 2 sig. figs. A1

(b) pressure of oil = pressure of water B1

(ii) **1.** $(p =)\ h\rho g$ C1
$(= 0.25 \times 1000 \times 10 =)$ 2500 Pa A1

2. $h\rho g = 2500$ C1
$(\rho = 2500 / (0.32 \times 10) =)$ 781 kg / m^3 to at least 2 sig. figs. A1

[Total: 9]

4 **(a) (i)** KE = ½mv^2 in any form **OR** ½mv^2 C1
(KE = 24.5 × 6.7 =) 164 J **OR** 160 J A1

(ii) efficiency = output (power) ÷ input (power)
OR <u>useful power</u> ÷ input (power) C1

0.08 × candidate's **(a)(i)** correctly evaluated A1

(b) use of $\rho = m \div V$ in any form **OR** $m \div V$ C1
$(\rho = 6.72 \div 5.6 =)$ 1.2 kg / m^3 A1

(c) rotation/movement of <u>wire</u>/coil **OR** rotation/movement of <u>magnet</u> B1

<u>consistent with above mark</u>: in magnetic field / between magnetic poles /
cutting magnetic field **OR** in coil / near wire B1

[Total: 8]

5	**(a**	**(i)**	(metals/they are) (good) conductors (of heat)	B1	[1]
		(ii)	(at hot end) molecules vibrate (more) **or** electrons identified as mechanism of conduction	B1	
			molecules collide with their neighbours **or** electrons move faster/have more energy	B1	
			energy/vibration passed on **or** electrons pass on energy/reach far end/free to move	B1	[3]
	(b)		determine mass of spoon (condone weigh provided word mass is used in answer)	B1	
			immerse spoon in water/liquid	B1	
			determine increase in volume/overflow	B1	
			$\rho = m/V$ **or** density = mass/volume	B1	[4]
					[Total: 8]

6	**(a**		ρgh in symbols, words or numbers	C1	
			700 Pa or N/m^2	A1	[2]
	(b)		use of $F = pA$	C1	
			14.7 N ecf from **(a)**	A1	[2]
	(c)		(30.9 – 14.7 =)16.2 N OR evidence of calculation of resultant	C1	
			use of $a = F/m$	C1	
			5.24 m/s^2	A1	[3]

7

(a)	(i)	$\frac{1}{2}mv^2$	C1	
		½ × 7500 × 12 × 12	C1	
		540 000 J OR 540 kJ	A1	
	(ii)	$W = E/t$ in any form	B1	
		10% × his (a)	C1	
		54 000 W OR 54 kW e.c.f.	A1	
(b)	(i)	3750 kg	B1	
	(ii)	[If ecf from (i) and no other errors, maximum mark is 2]		
		mass: ½ OR correct sub in $\frac{1}{2}mv^2$	C1	
		speed: ½ OR 6750 (J)	C1	
		fraction = ⅛ / 0.125 / 1:8 ? 12.5 % (c.a.o.)	A1	[10]

8

(a)		P = hdg or 2 x 1000 x 10	**C1**	
		= 20 000 N/m^2 or Pa	**A1**	**[2]**
(b)		p = f/a or 20 000 = 50/a	**C1**	
		a = 0.0025 m^2	**A1**	**[2]**
(c)		potential energy of the water	**B1**	
		converted to kinetic energy of water through outlet (and heat)	**B1**	**[2]**
				Total[6]