

- 1 (a) $W = mg$ in any form OR ($m =$) $W \div g$ OR $80\,000 \div 10$
8000 kg C1
A1
- (b) $\rho = m \div V$ in any form OR ($V =$) $m \div \rho$ OR $8000 \div 1000$
 $= 8.0\text{m}^3$ ecf (a) C1
A1
- (c) mgh OR weight $\times h$ OR $8000 \times 10 \times 4$ C1
 $= 320\,000\text{J}$ OR 320kJ ecf (a) A1
- (d) (efficiency =) output (energy) \div input (energy) ($\times 100$)
OR $96 \div 320 (\times 100)$ C1
 $= 0.30$ OR 30% ecf (c) A1

[Total: 8]

- 2 (a) (i) ($W = mg = 1440 \times 10 =$) 14 400 N B1
- (ii) ($P =$) F/A OR $14\,400 / (1.5 \times 1.2)$ C1
8000 Pa OR N/m^2 A1
- (b) (i) ($P =$) $h\rho g$ OR $1.4 \times 1000 \times 10$ C1
14 000 Pa OR N/m^2 A1
- (b) (ii) pressure on base of **P** smaller / **Q** greater
(with same volume removed) smaller decrease in depth in Q
OR height in **Q** is greater A1

[Total: 7]

3	(a) (i) 180 N	B1	
	(ii) $(P =) F \div A$ OR $180 \div (0.30 \times 0.04)$ 15000 Pa	C1 A1	
	(b) (i) arrow (labelled W) from/to correct centre of mass	B1	
	(ii) 1. force \times (perpendicular) distance OR 40×0.60 OR 180×0.15 in 2. 24 Nm	C1 A1	
	2. 27 Nm	e.c.f. from (a)(i)	A1
	(iii) slab topples/rotates (about point D) OR corner C lifts from ground OR falls over	B1	
	<u>moment</u> of force at B becomes bigger than <u>moment</u> of weight / W OR anticlockwise <u>moment</u> becomes bigger than clockwise <u>moment</u> OR weight/centre of mass outside base	B1	
			[Total: 9]

4	(a) 85 000 N (accept 83 300 N)		
	(b) ($(P =) F/A$ OR $85\,000/3.4$ OR $85\,000/3.4 \times 2$ OR $85\,000/6.8$ (e.c.f. from (a)(i)) $1.2/1.25/1.3 \times 10^4$ Pa (e.c.f. from (a)(i))	C1 A	
	(ii) larger area smaller pressure	M1 A1	
	(c) (i) (measure of) turning effect OR $F \times x$	B1	
	(ii) no resultant/net force no resultant/net turning effect/moment	B1 B1	[8]

- 5 (a) $\text{mass} = (1.5 \times 10 \times 12)/(30 \times 10)$ OR $= (1.5 \times 12)/30$
OR any correct moment equation with force or mass but not mixture
 $= 0.6(0) \text{ kg}$ C1
A1 [2]
- (b) 21 N ecf from (a) B1 [1]
- (c) (i) stays in position B1
- (ii) any two from:
- clockwise moment = anticlockwise moment B1
 - centre of mass at pivot B1
 - no (resultant) moment/turning force acting on sculpture
 - balanced/in equilibrium
 - relative distances from pivot unchanged [3]
- [Total: 6]**