1 **(a** $W = mg$ in any form OR $(m =) W \div g$ OR $80\,000 \div 10$ C1
8000 kg A1

(b) $\rho = m \div V$ in any form OR $(V =) m \div \rho$ OR $8000 \div 1000$ C1
$= 8.0\,m^3$ ecf **(a)** A1

(c) mgh OR weight $\times$ h OR $8000 \times 10 \times 4$ C1
$= 320\,000$ J OR 320 kJ ecf **(a)** A1

(d) (efficiency =) output (energy) ÷ input (energy) ($\times$ 100)
OR 96 ÷ 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* ÷ *A* **OR** 180÷(0.30 × 0.04) C1
15 000 Pa A1

(b) (i) arrow (labelled *W*) from / to correct centre of mass B1

(ii) **1.** force × (perpendicular) distance **OR** 40 × 0.60 **OR** 180 × 0.15 in **2.** C1
24 N m A1

2. 27 N m e.c.f. from **(a)(i)** A1

(iii) slab topples / rotates (about point D) **OR** corner C lifts from ground
OR falls over B1

moment of force at B becomes bigger than moment of weight / W
OR anticlockwise moment becomes bigger than clockwise moment
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 × 2 OR 85 000/6.8 (e.c.f. from **(a)(i)**) C1
1.2/1.25/1.3 × 10^4 Pa (e.c.f. from **(a)(i)**) A

(ii) larger area M1
smaller pressure A1

(c) (i**)** (measure of) turning effect OR *F* × *x* B1

(ii) no resultant/net force B1
no resultant/net turning effect/moment B1 [8]

5 **(a** mass = (1.5 × 10 × 12)/(30 × 10) OR = (1.5 × 12)/30 C1
OR any correct moment equation with force or mass but not mixture
= 0.6(0) kg 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]