

# Density

## Mark Scheme 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Density
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme2

**Time Allowed:** 77 minutes

**Score:** /64

**Percentage:** /100

- 1 (a) (mass flow rate =) 1030 (kg/s)  
 use of  $mgh$  C1  
 loss of GPE =  $1030 \times 10 \times 3 = 30\,900$  J or Nm ecf from 1st line A1 [3]
- (b) output power =  $(26 \times 400 =) 10\,400$  (W)  
 efficiency = output (power)/input (power) with/without 100  
 OR= output/input with/without 100 OR any numbers  
 that clearly show relationship the correct way up is intended C1  
 efficiency =  $(100 \times 10\,400/30\,900 = ) 33.7\%$  at least 2 s.f. A1 [3]  
 allow ecf from (a) and 1st line of (b)
- (c) (i) from basin/to sea/from right/to left B1
- (ii) turbine design allows rotation in both directions  
 OR meaningful comment on change of pitch  
 OR generator works when rotating in either direction B1 [2]
- [Total: 8]
- 2 (a)  $M = V \times D$  in any form OR  $10^3 \times 10^{-3}$  C1  
 1 kg A1
- (b)  $mgh$  OR his (a)  $\times 10 \times 0.8$  C1  
 8 J (Nm) OR 7.85 J OR 7.84 J e.c.f. from (a) A1
- (c)  $P = E/t$  OR (his  $8 \times 90$ ) / 60 e.c.f. from (b) C1  
 12 W (J/s or Nm/s) OR 11.77 W OR 11.76 W A1
- (d)  $pg_h$  in any form, words, letters, numbers C1  
 8000 Pa ( $N/m^2$ ) OR 7850 Pa OR 7840 Pa A1 [8]

- 3 (a) measuring cylinder with liquid B1  
 immerse statue B1  
 volume from difference of readings from measuring cylinder B1  
 OR  
 displacement can/equivalent/beaker, filled to overflowing with liquid (B1)  
 immerse statue (B1)  
 measure volume displaced with measuring cylinder (B1)
- (b) (D =) M/V OR 600/65 B1  
 9.23 g/cm<sup>3</sup> (minimum 2 s.f.) N.B. unit penalty applies B1  
 OR  
 (For gold) (M =) V × D OR 65 × 19 (B1)  
 1235 g (minimum 2 s.f.) N.B. unit penalty applies (B1)  
 OR  
 (For gold) (V =) M / D OR 600/19 (B1)  
 31.6 cm<sup>3</sup> (minimum 2 s.f.) N.B. unit penalty applies (B1)
- 'NO' ticked if justified by previous work in (a) or (b).  
 e.c.f from wrong values abo B1
- [6]**
- 4 (a) pressure = hdg or 20 x 1000 x 10 1  
 = 2 x 10<sup>5</sup> Pa 1 2
- (b) force = pressure x area or 2 x 10<sup>5</sup> x 0.5 e.c.f. 1  
 = 1 x 10<sup>5</sup> N 1 2
- (c) potential energy (at water surface) 1  
 changed to kinetic energy (at pipe exit) 1 2  
**(6)**

- 5 (a) Example: e.g. battery: (chemical to) electrical  
 engine: (chemical to) kinetic / mechanical  
 fire: (chemical to) thermal / heat  
 (human) body: (chemical to) heat / kinetic B1
- (b) (i)  $(P =) IV$  OR in words OR  $0.27 \times 17$   
 $= 4.59 \text{ W}$  at least 2 s.f. C1  
 A1
- (ii) (K.E. =) efficiency  $\times$  input OR  $0.35 \times 4.59$   
 $= 1.61 \text{ J or Nm}$  at least 2 s.f. C1  
 A1
- (iii) 1.  $d = m/V$  OR  $(m =) V \times d$  OR in words OR  $0.00014 \times 1000$   
 $= 0.14 \text{ kg}$  C1
2. P.E. gained = K.E. lost OR  $mgh = \frac{1}{2} mv^2$   
 OR  $0.14 \times 10 \times h = 1.61$  OR  $1.6$  C1  
 $h = 1.15 \text{ m}$  OR  $1.14 \text{ m}$  at least 2 s.f. A1
- OR  
 $\frac{1}{2} mv^2 = 1.61$  OR  
 $v^2 = 2 \times 1.61 / 0.14 = 23$  OR  $v^2 = 2 \times 1.6 / 0.14 = 22.86$  (C1)  
 $(h =) v^2/2g = 23/20 = 1.15 \text{ m}$  OR  $(h =) 22.86/20 = 1.14 \text{ m}$  (A1)
- [Total: 9]**
- 6 (a) (i)  $t = v/g$  or  $32/10$   
 $= 3.2 \text{ s}$  C1  
 A1
- (ii) straight line starting at zero, inclined  
 line joining 0,0 and 3.2, 32, accept c.f. from time (i) C1  
 A1
- (iii) 2.4 kg A1 [5]
- (b) (i) take volume of water before use B1  
 (totally) immerse stone and take new volume B1  
 (Not clearly measured before and after C1)
- (ii) hang rock from balance and take reading B1
- (iii) density = mass/volume B1
- (iv) need to tie "sinker" or cork or press cork down B1  
 need volume with sinker then volume with sinker and cork or just completely submerge  
 cork B1 [6]
- [Total: 11]**

7 (a)	one mark for each labelled diagram both diagrams sensible but no labels	max 1	2	2
(b)	newtons/10 is kg or equivalent		1	1
(c)	volume/level/reading of water then volume etc. water + rock		1	1
(d)	difference in the two readings		1	1
(e)	density = mass/volume		1	1
				(6)

8 a(i)	outline, ruler pivoted (at centre), mass one side, rock other side quality set-up, each mass at (marked) point + labels				C1 2 A1
(ii)	<del>rod must be balanced before readings can be taken or record mass as 100 g</del> distances to pivot from rock <del>and mass B</del> distance pivot to mass B   mass or 100 x distance to pivot = mass of rock x distance rock to pivot				<del>B1</del> B2 3 B1 5
b	put water in cylinder, read value insert rock <u>until covered</u> , read value difference in values is volume of rock				B1 B1 2 B1 M2*
c	density = mass/volume or 88/24 = 3.7 g/cm <sup>3</sup> * (accept 3 2/3 g/cm <sup>3</sup> )				C1 2 A1 2 QT 9