

# Energy, Work and Power

## Mark Scheme 4

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Energy, Work and Power
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 4

**Time Allowed:** 58 minutes

**Score:** /48

**Percentage:** /100

- 1 (a) (i) (GPE =)  $mgh$  or  $0.40 \times 10 \times 8.5$  (accept 9.8 for 10)  
34 J C1  
A1 [2]
- (ii) KE = GPE in any form or  $\frac{1}{2}mv^2$  or  $2gh$   
or  $2 \times 10 \times 8.5$  (e.c.f. from 4(a)(i)) C1  
( $v^2 =$ ) 170 or ( $v =$ ) $\sqrt{170}$   
(e.c.f. from 4(a)(i)) C1  
13 m/s e.c.f. from 4(a)(i) A1 [3]
- (b) drag or air resistance or friction with air (ignore wind for air) B1  
WD or energy lost as heat or more KE needed to overcome drag etc. B1 [2]
- (c) transformed to thermal energy/heat or friction/air resistance slows parachutist down  
or lost to air particles  
(not KE (accept KE of air), not GPE  $\rightarrow$  KE  $\rightarrow$  heat; ignore sound) B1 [1]
- [Total: 8]
- 2 (a) (nuclear) fusion B1 [1]
- (b) (i) smaller (surface) area  
(accept thinner, narrower(at top), ignore reference to lid) B1 [1]
- (ii) apparatus: black object, white object, thermometer(s)/ball-bearing with  
wax/level of water in vessel B1
- source of heat e.g. Sun/radiant heater (condone light bulb/Bunsen burner) B1
- action: (fill cans with water and) measure temperature rise or wax melts or  
compare volumes of water B1
- observation: water in black can (better absorber) has greater temperature  
increase / wax melts first / less water  
note: emission experiment gains max. 2 B1 [4]
- [Total: 6]

- 3 (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 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]

- 4 (a)  $\frac{1}{2} mv^2$  C1  
 correct rearrangement to find  $v/v^2$  C1  
 $23 \text{ m/s}$  A1 [3]  
 bald 0.73 scores first two marks
- (b) use of  $mgh$  ( $= 160\,000 - 40\,000 = 120\,000 \text{ J}$ ) C1  
 $h = 20 \text{ m}$  A1 [2]
- (c) any three points from:  
 KE of water  
 PE of water  
 sound  
 heat/friction  
 Award one mark for each correct point B3 [3]

- 5 (a) distance/height AND tape measure/(metre) rule(r) B1  
 weight OR load OR force  
 AND balance/scale(s) OR newton-meter/spring balance/force meter B1  
 time AND watch/clock/timer B1
- (b) power = work/time OR energy/time in any form  
 OR  $Pt$  words or numbers seen anywhere e.g.  $528 \times 5$  C1  
 (work =) force  $\times$  distance in any form C1  
 11 A1
- (c) efficiency =  $E_{out}/E_{in}$  OR  $P_{out}/P_{in}$  seen anywhere, clearly identified  
 OR  $520 \times (20/11) \times 5$   
 OR (work done =)  $800 \times 20 \times 0.3$  OR  $800 \times 20 \times 30$  OR 4800 (J) OR 720 (J) C1  
 (energy used =) 32,000 J A1 [8]
- 6 (a) kinetic energy (of the package / belt / motor)  
 heat / thermal / internal energy / work done against friction  
 sound energy B2
- (b)  $mgh$  OR  $36 \times 10 \times 2.4$  C1  
 = 864 J OR Nm A
- (c)  $P = E/t$  in any form: words, symbols or numbers  
 OR  $E/t$  OR  $864 / 4.4$  C1  
 = 196 W OR J/s A
- (d)  $P = E/t$  in any form, words or symbols  
 OR mass is increased AND power is constant B1
- increase in potential energy of mass is greater  
 OR work done / energy used (to raise mass) is greater B1
- speed reduced / time taken is longer B1 [9]