

ENERGY ANSWERS OCR ALEVEL YEAR 1

1.

Question	Expected Answers	Marks	Additional Guidance
(a)	Energy cannot be created or destroyed; it can only be transferred/transformed into other forms or The (total) energy of a system remains constant or (total) initial energy = (total) final energy (AW)	B1	Allow: 'Energy cannot be created / destroyed / lost'
(b)	Any suitable example of something strained (eg: stretched elastic band)	B1	
(c) (i)	$E_p = mgh$ and $E_k = \frac{1}{2}mv^2$ (Allow Δh for h)	B1	Not: $E_k = mgh$
(ii)	$mgh = \frac{1}{2}mv^2$ $v^2 = 2gh$ or $v = \sqrt{2gh}$	B1 B1	
(d) (i)	$m = \rho V$ $m = 1.0 \times 10^3 \times (1.2 \times 10^{-2} \times 2.0 \times 10^7)$ mass of water = 2.4×10^8 (kg)	C1 C1 A0	Allow any subject for the density equation
(ii)	loss in potential energy = $2.4 \times 10^8 \times 9.81 \times 2.5 \times 10^3$ 30% of GPE = $0.3 \times 5.89 \times 10^{12}$ ($= 1.77 \times 10^{12}$) power = $\frac{1.77 \times 10^{12}}{900}$ power = $1.9(63) \times 10^9$ (W) (≈ 2 GW)	C1 C1 C1 A0	Allow 1 mark for ' 5.89×10^{12} (J)' Allow 2 marks for ' 1.77×10^{12} (J)' Note: $\frac{5.89 \times 10^{12}}{900}$ ($= 6.5$ GW) scores 2 marks
(iii)	Any correct suitable suggestion; eg: the energy supply is not constant/ cannot capture all the rain water / large area (for collection)	B1	Note: Do not allow reference to 'inefficiency' / 'cost'
	Total	11	

2.

a	kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{speed}^2$	B1	Allow KE = $\frac{1}{2}mv^2$, where m = mass and v = speed Allow velocity instead of speed Not: KE = $\frac{1}{2}mv^2$ on its own
b(i)	initial KE = $\frac{1}{2} \times 3.0 \times 10^{-2} \times 200^2$ ($= 600$ J) final KE = $\frac{1}{2} \times 3.0 \times 10^{-2} \times 50^2$ ($= 37.5$ J) Loss in KE = $600 - 37.5$ Loss in KE = 562.5 (J) ≈ 560 (J)	C1 C1 A1	Special case: 1 mark for 'KE = $\frac{1}{2}mv^2$... loss in KE = ($\frac{1}{2} \times 3.0 \times 10^{-2} \times 200 - \frac{1}{2} \times 3.0 \times 10^{-2} \times 50$) = 2.25 (J)' Note: No marks for 337.5 (J) when Δv used in the KE equation ($\frac{1}{2} \times 3.0 \times 10^{-2} \times 150^2 = 337.5$ J)
b(ii)	work done = (loss in) KE / $a = (v^2 - u^2) / 2s$ $F \times 1.5 \times 10^{-2} = 562.5$ / $a = (-) 1.25 \times 10^6$ force = 3.75×10^4 (N)	C1 A1	Possible ecf from (b)(i) Allow: A 2 sf answer of either 3.8×10^4 (N) or 3.7×10^4 (N)

3.

question	Answers	Marks	Guidance
(a)	<u>total</u> energy of a (closed) system remains constant or Energy cannot be created or destroyed (it can only be transferred into other forms) or <u>total</u> initial energy = <u>total</u> final energy	B1	Not: 'Energy cannot be created / destroyed / lost'
(b)	work done = force × distance <u>moved</u> in the direction of the force Unit: N m or J	M1 A1 B1	Allow: 'force × displacement' for the M1 mark Note: The unit mark is an independent mark
(c) (i)	<u>kinetic</u> energy → heat	B1	Not: friction / deformation / sound / KE of dust / KE of Earth
(ii)	$(E = \frac{1}{2}mv^2)$ $8.4 \times 10^{16} = \frac{1}{2} \times 3.0 \times 10^8 \times v^2$ $v^2 = \frac{2 \times 8.4 \times 10^{16}}{3.0 \times 10^8}$ or $v = \sqrt{\frac{2 \times 8.4 \times 10^{16}}{3.0 \times 10^8}}$ ($v = 2.37 \times 10^4 \text{ m s}^{-1}$)	C1 C1 A0	Note: This mark is for correct substitution Allow: 2 marks for $v^2 = 5.6 \times 10^8$ Allow: 1 mark for a bald answer of 2.4×10^4
(iii)	$8.4 \times 10^{16} = F \times 200$ $F = \frac{8.4 \times 10^{16}}{200}$ force = 4.2×10^{14} (N)	C1 C1 A1	Possible ecf Allow: $a = (-)\frac{u^2}{2s}$ $a = (-)\frac{(2.37 \times 10^4)^2}{2 \times 200}$ or $a = (-)\frac{(2 \times 10^4)^2}{2 \times 200}$ C1 $a = 1.4 \times 10^6 \text{ (m s}^{-2}\text{)}$ or $a = 1.0 \times 10^6 \text{ (m s}^{-2}\text{)}$ C1 $F = 3.0 \times 10^8 \times 1.4 \times 10^6$ or $F = 3.0 \times 10^8 \times 1.0 \times 10^6$ force = 4.2×10^{14} (N) or force = 3.0×10^{14} (N) A1
	Total	10	