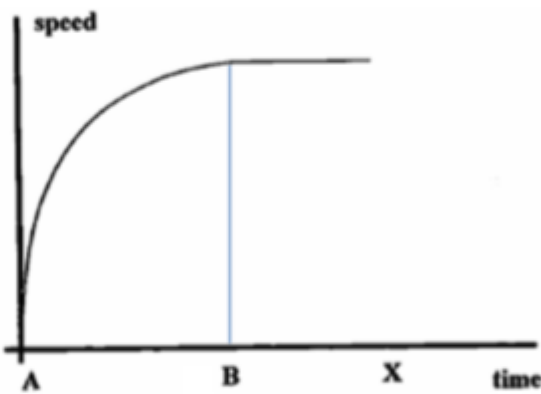


## AQA 2 Answers – Energy (set 2)

### June 12 Q2

2	a		<p><math>GPE</math> to <math>KE</math> to <math>GPE</math> ✓</p> <p>no energy lost (from system) / no <u>work done</u> against resistive forces ✓</p> <p>initial <math>GPE</math> = final (<math>GPE</math>) / initial (<math>GPE</math>) = final <math>GPE</math></p> <p><b>OR</b> <math>h = GPE / mg</math> and these are all constant so <math>h</math> is the same ✓</p>	3
2	b		<p>Initial curve with decreasing gradient and reaching constant maximum speed before X and maintaining constant speed up to X ✓</p> <p>B labelled in correct place ✓</p> <p>B labelled in correct place <b>AND</b> constant speed maintained for remainder of candidates graph and line is straight ✓</p> 	3
2	c		<p>(first law) ball travels in a <u>straight line</u> at a constant speed / constant <u>velocity</u> / (maintains) <u>uniform</u> / <u>no change in</u> motion / zero acceleration ✓</p> <p>there is no (external) <b>unbalanced</b> / <b>resultant force</b> acting on it ✓</p>	2

## AQA 2 Answers – Energy (set 2)

### Jan 13 Q1

Question			Mark & Comments	
1	a	$(Ep = mg\Delta h)$ $= 65 \times 9.81 \times 54 \checkmark$ $= 3.44 \times 10^4 = 3.4 \times 10^4 \text{ (J)} \checkmark \text{ (34433)}$	2	max 1 if $g = 10$ used (35100 J) Correct answer gains both marks
1	b	$v = \sqrt{\frac{2Ep}{m}}$ OR $v = \sqrt{\frac{2 \times 34433}{65}} \checkmark = 33 \text{ (32.55 ms}^{-1}\text{)} \checkmark \text{ ecf 1(a)}$ OR correct use of $v^2 = 2gs$	2	allow 32 (32.3) for the use of 34000 allow 32.6 don't penalise $g=10$ (32.863)
1	c	$(s = 1/2 gt^2 \text{ or other kinematics equation})$ $t = \sqrt{\frac{2s}{g}}$ OR $t = \sqrt{\frac{2 \times 54}{9.81}} \checkmark = 3.318 = 3.3 \text{ (s)} \checkmark$ ecf from 1(b) if speed used	2	With use of $g = 9.8$ or $9.81$ or $10$ and/or various suvat equations, expect range 3.2 to 3.4 s. No penalty for using $g = 10$ here.
1	d	(all G)PE (lost) is transferred to KE no (GP)E transferred to 'heat' / 'thermal' / internal energy OR $\checkmark$ (therefore) $mg\Delta h = \frac{1}{2}mv^2 \checkmark$ mass cancels $\checkmark$	3	Must imply that <u>all</u> GPE is transferred to KE. E.g. accept 'loss of GPE is gain in KE' but not: 'loses GPE and gains KE'. Accept 'm's crossed out
total			9	

### Jan 13 Q2

2	a	$(s = \frac{1}{2}(u + v)t)$ $u = \frac{2s}{t} - v$ OR substitution in above equation OR $u = \frac{2 \times 1.5}{0.42} - 5.0 \checkmark$ $= 6.9767 - 5.0 \checkmark = 2.0 \checkmark (1.98 \text{ ms}^{-1})$	3	Correct answer with no working gets 2 out of three. Full credit for use of $g \sin 25^\circ =$ acceleration down slope. This yields answer $3.22 \text{ ms}^{-1}$ Allow 1sf answer (2).	
2	b	i	$(F = 75 \times 9.81 \times \sin 25^\circ) \checkmark$ $= 310 (311, 310.94) \text{ (N)} \checkmark$	2	use of $g = 10$ not penalised here 'sin25' on its own  Use of $g=10$ yields 317  Allow cos65
2	b	ii	$W = Fs$ $= 311 \times 2.0 = 620 (622 \text{ J}) \checkmark$ ecf (2bi) $\times 2.0$	1	
2	c		Idea that GPE is ultimately transferred to: internal (energy) / 'heat' / 'thermal' (energy in the surroundings) $\checkmark$  Correct reference to a named resistive force: friction / drag / air resistance $\checkmark$  All GPE becomes 'heat', etc OR no (overall) increase in KE OR reference to <u>work done</u> against or by a resistive force $\checkmark$	3	Allow transfer of GPE to KE and then to 'thermal' etc Do not allow reference to 'sound' on its own Don't accept implication that a resistive force is a form of energy Do not allow references to loss of body heat. Allow: '(GPE) not converted to KE'
total			9		

## AQA 2 Answers – Energy (set 2)

### June 13 Q1

1	a	i	1000(N) AND 6000(N) seen <b>OR</b> $F = \sqrt{(1000)^2 + (6000)^2}$ ✓ allow incorrect values seen = <b>6083</b> (N) (= 6100) ✓ More than 2 sf seen	2	Independent marks  Allow full credit for appropriate scale drawing Ignore rounding errors in 3 <sup>rd</sup> sig fig.
1	a	ii	$\tan \Theta = 1000 / 6000$ or correct use of sin or cos ✓ $\Theta = 9.5$ (9.46°) ✓ Allow range 9.4 – 10.4	2	Use of cos yields 10.4 Allow use of 6100 Some working required for 2 marks. Max 1 mark for correct calculation of vertical angle (range 79.6 – 80.6) some working must be seen
1	a	iii	$(m = W/g = ) 6500 / 9.81$ (= 662.6 kg) ✓ $(a = F/m = 6083 / 662.6)$ = 9.2 (ms <sup>-2</sup> ) ✓ (9.180)	2	Use of weight rather than mass gets zero Correct answer on its own gets 2 marks Penalise use of g=10 in this question part only (max 1)
1	b	i	= 6500 × 600 ✓ (662.6 × 9.81 × 600) = 3 900 000 ✓ (J)	2	Look out for $W \times g \times h$ which gives 39000000 (gets zero) Correct answer on its own gets 2 marks <b>Do not allow use of <math>1/2mv^2</math> (= 39 000)</b>
1	b	ii	(E= Pt =) 320 000 × 55 (= 17 600 k J ) <b>OR</b> $P = 1(b)(i) / 55$ (7.09x10 <sup>4</sup> ) ✓ 3.9 / 17.6 OR 70.9 / 320 OR = 0.22(16) ✓ ecf from first line  conversion to a percentage (= 22 %) ✓	3	Some valid working required for 3 marks  Look out for physics error: Power/time (320/55) then use of inverted efficiency equation yielding correct answer Do not allow percentages >= 100% for third mark

## AQA 2 Answers – Energy (set 2)

### June 14 Q1

1	a		$8300 \times 9.81$ OR $= 81423$ ✓ $(8300 \times 9.81 \sin 25)$ $= 3.4 \times 10^4$ (N) ✓ (34 411 N) ecf from first line unless g not used  $m \sin 25$ gets zero	2		Penalize use of $g=10$ <u>here only</u> (35 077 N) Allow 9.8 in any question  <b>Correct answer only, gets both marks for all two mark questions</b>
1	b	i	$(E_k = \frac{1}{2}mv^2)$ $= \frac{1}{2} \times 8300 \times 56^2$ ✓ $= 1.3 \times 10^7$ (J) ✓ (13 014 400) allow use of 8300 only	2		In general: Penalise transcription errors and rounding errors in answers
1	b	ii	$mgh = KE$ (13 014 400) for $mgh$ allow GPE or $E_p$ OR 13 014 400 / 81 423 ✓ $h = 160$ (m) ✓ (159.8) ecf 1bi	2		Allow use of suvat approach
1	c	i	(work done) by friction \ drag \ air resistance \ resistive forces ✓ (Energy converted) to internal \ thermal energy ✓	2		Allow 'heat'
1	c	ii	$0.87 \times (8300 \times 9.81 \times 140 = 9\,917\,000)$ OR $v = \sqrt{\frac{2 \times (9\,917\,000)}{8300}}$ ✓ $= 49$ ( $= 48.88 \text{ ms}^{-1}$ ) ✓	2		87% of energy for 140m or 160m only for first mark. Use of 160 (52.26) and/or incorrect or no % (52.4) gets max 1 provided working is shown. <b>Do not credit suvat approaches here.</b>

## AQA 2 Answers – Energy (set 2)

### June 16 Q4

4(a)	energy cannot be created or destroyed ✓ it can only be transferred/changed/converted from one form to another ✓	'Transformed' can be taken to mean transferred from one form to another.	2	
4(b)(i)	(using $E_k = \frac{1}{2}mv^2$ ) $2.2 = \frac{1}{2} \times 0.40 \times v^2$ $v = 3.3 \text{ (ms}^{-1}\text{)} \checkmark$	Ignore errors in 3 sig fig. Answer only can gain mark.	1	
4(b)(ii)	(using work done = $F \times s$ ) $2.2 = F \times 1.2 \checkmark$ ( $F = 1.83 \text{ N}$ ) or (using $a = (v^2 - u^2) / 2s$ ) $a = (0^2 - 3.32^2) / 2 \times 1.2 = (-) 4.59 \text{ (m s}^{-1}\text{)}$	A substitution of numbers are necessary for the mark	1	
	$(F = ma) = 0.4 \times 4.59 \checkmark = (1.84 \text{ N})$			
4(b)(iii)	(work done in moving 0.2 m) $= 1.8 \times 0.2 \text{ (J)} \checkmark (= 0.36 \text{ J})$ (allow ecf (bii) $\times 0.2$ ) total work done $= 2.2 + 0.36 = 2.6 \checkmark$ (same answer is achieved if $F = 2\text{N}$ ) J or joule ✓		3	
4(b)(iv)	(use of energy $= \frac{1}{2}Fx$ ) $2.6 = \frac{1}{2}F_{\max} 0.2$ $F_{\max} = 26 \text{ N} \checkmark$ (allow ecf $10 \times$ (biii))	Allow mark for answer only even for ecf.	1	