

The kinetic energy of objects speeding up or slowing down

1.	(a)	(i)	50 (N) <i>ignore any units</i>	1	
		(ii)	resultant force	1	
		(iii)	4000 <i>accept their (a)(i) × 80 correctly calculated for 2 marks</i> <i>allow 1 mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80</i> <i>ignore any units</i>	2	
	(b)	(i)	joule	1	
		(ii)	heat	1	[6]
2.	(a)	(i)	0.6 <i>allow 1 mark for correct substitution</i> newtons <i>accept N; do not accept n</i> <i>accept Newtons</i>	2	
		(ii)	the same as	1	
	(b)	(i)	changed velocity <i>accept increased/ decreased for change</i> <i>accept speed for velocity; accept <u>change</u> direction</i> <i>accept getting faster/ slower; accept start/ stop moving</i> <i>accept correct equation in terms of change in speed or change in velocity</i>	1	
		(ii)	down(wards) <i>accept towards the ground</i> <i>accept ↓</i> <i>do not accept south</i>	1	
		(iii)	increase velocity is increasing <i>can only credit second mark if answer is increase</i>	1	
		or	it is accelerating <i>accept speed for velocity; accept is moving faster</i> <i>accept an answer in terms of resultant force downwards</i> <i>mention of weight/ mass increasing negates second mark</i>	1	[8]
3.	(a)	(i)	kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{speed}^2$ <i>accept ke = $\frac{1}{2} mv^2$</i> <i>do not accept KE = $\frac{1}{2} ms^2$</i>	1	
		(ii)	13 <i>allow 1 mark for correct substitution or transformation</i>	2	
	(b)		<i>if B is at the top of the curve - no marks</i> PE at A maximum PE at B minimum PE at C just less than or = to A <i>do not accept wavy lines or very non-symmetrical</i> <i>accept straight lines or curves</i>	1	
			difference between A and B is 5000 to 5200	1	[5]

4. (a) $p = mgh$
 $= 50 \times 10 \times 4$
 $= 2000$
 J/Nm (see marking of calculations) 4
- (b) $k = \frac{1}{2} mv^2$
 $= \frac{1}{2} \times 50 \times 8^2$
 $= 1600$
 J/Nm (see marking of calculations) 4
- (c) work is done against air resistance 2
 fall of her C of G differs from rise in climbing stairs
 part of gained pe used to rotate body
 diver gains PE on take-off
any 2 for 1 mark each

[10]

5. (a) *ideas that* greater speed means more kinetic energy 3
gains 1 mark
but any evidence of the formula $\frac{1}{2} mv^2$
but making the case that kinetic energy depends on the speed squared
gains 3 marks
or that $2^2 = 4$
- (b) any evidence of concept of momentum or mass \times speed 6
 (or velocity) in words or figures e.g. 9.5×20 **or** 0.5×40
gains 1 mark
but correct values for momentum of lorry and car i.e. 190 and 20
 [ignore units]
gains 2 marks
but initial momentum correctly calculated 170 or $190 - 20$
gains 3 marks
THEN evidence when calculating final speed of idea that momentum is
 conserved use of combined mass
each gain 1 mark
but 17 [or $0.1 \times$ figure for initial momentum] (NB direction not required)
gains 3 marks

[9]