

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Mark Schemes

Q1.

(a) they vibrate about fixed positions. 1

(b) kinetic energy decreases potential energy decreases 1

(c) metal: has a high thermal conductivity 1

which increases the rate of energy transfer from the mixture
allow ice cream for mixture 1

plastic: has a low thermal conductivity 1

which reduces the rate of energy transfer from the surroundings (to the liquid coolant at -20°C)
ignore references to insulation throughout 1

(d) a high specific heat capacity 1

so it can absorb a large amount of energy with only a small temperature change 1

(e) $165 \text{ kJ} = 165000 \text{ J}$ 1

$\Delta E = m \times 3500 \times 21.5$
and
 $\Delta E = m \times 255000$ 1

$165000 = 75250 m + 255000 m$
or
 $165000 = 330250 m$
this mark may be awarded if E is incorrectly/not converted 1

$m = \frac{165000}{75250 + 255000}$
or
this mark may be awarded if E is incorrectly/not converted 1

$$m = \frac{165000}{3500}$$

allow an answer consistent with their value of E

$$m = 0.499621 \text{ (kg)}$$

1

$$m = 0.50 \text{ (kg)}$$

this answer only

If no marks awarded other than the first marking point:

either

$$165\,000 = m \times 3500 \times 21.5 \text{ scores } \mathbf{1} \text{ mark}$$

$$m = 2.192\dots \text{ scores } \mathbf{1} \text{ mark}$$

$$m = 2.2 \text{ (kg) scores } \mathbf{1} \text{ mark.}$$

these marks may be awarded if E is incorrectly/not converted

or

$$165\,000 = m \times 255\,000 \text{ scores } \mathbf{1} \text{ mark}$$

$$m = 0.647 \text{ scores } \mathbf{1} \text{ mark}$$

$$m = 0.65 \text{ kg scores } \mathbf{1} \text{ mark.}$$

these marks may be awarded if E is incorrectly/not converted

1

[14]

Q2.

- (a) the (maximum tendon) extension increases (as speed increases)

allow the tendons stretch more (as speed increases)

1

so the elastic potential energy increases

allow so the (elastic) force increases

1

which is transferred to gravitational potential energy

1

(b) $E = 770 \times 0.14$

allow $E = 107.8 \text{ (J)}$

1

$$\text{extension} = 0.070 \text{ m}$$

1

$$107.8 = 0.5 \times k \times 0.070^2$$

this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied

1

$$k = 2 \times \frac{107.8}{0.070^2}$$

this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied

$$k = 44\,000 \text{ (N/m)}$$

this mark may be awarded if extension is incorrectly/not converted

this mark may not be awarded if the efficiency equation has not been applied