Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) correctly deduces extension is 2.6 or 2.7 mm ✔

Should see $AC^2 = 1.50^2 + (6.34 \times 10^{-2})^2$;

(new) $AC = 1.50134$;

Extension of AC = (1.50134 − 1.50 =) 0.00134 m or 1.34 mm; and then doubles this

Final value must be to at least 2 sf

1

(b) evidence of correct working: ✔

$\sin\theta = \frac{6.34\times10^{-2}}{\text{their new AC}}$ or $\theta = 2.42°$ seen

OR

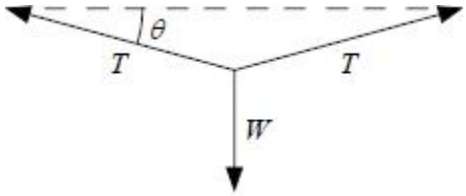
$W = 2T\sin\theta$ seen

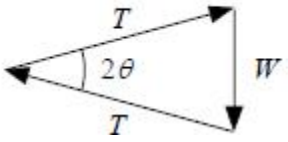
OR

suitable vector diagram with θ labelled

tension correctly calculated from $\frac{1.0}{2\times\text{their }\sin\theta}$ ✓

For 1 ✔ acceptable diagrams are shown below





Correct final answer of 11.8 N or 12 N earns both marks

2

(c) ruled best-fit line between first and sixth points;

line must pass above 2nd point

and

must pass below 4th point $_1$✔

for $_1$✔ withhold mark if line is thick, faint or discontinuous

gradient calculated from $\frac{\Delta(w/y)}{\Delta y^2}$ with $\Delta y^2 \geq 0.004$ $_2$✔

(gradient ~ 3850)

for $_2$✔ condone read off errors of ± 1 division

for $_3$✔ note that $1.50^3 = 3.375$ so allow sub of 3.38

for $_4$✔ reject 2 sf 1.2×10^{11}

evidence of using E = $\frac{\text{their gradient} \times 1.50^3}{1.11 \times 10^{-7}}$ $_3$✔

for $_3$✔ note that $1.50^3 = 3.375$ so allow sub of 3.38

E in range 1.10×10^{11} to 1.24×10^{11} (Pa) $_4$✔

for $_4$✔ reject 2 sf 1.2×10^{11}

4

(d) kg s^{-2} ✔

no credit for N m^{-1}

correct answer only

1

[8]

Q2.

(a) 28 (°C) ✔

1

(b) The energy transferred reduces the number of nearest atomic neighbours

First alternative must not imply total loss of intermolecular forces or neighbours.

A reference to 'breaking <u>the</u> bonds' implies all the bonds and does not gain the mark.

No mark for saying bonds weaken.

However these errors in discussing the bonds does not prevent a mark coming from another point

OR

allows atoms to move their centre of vibration

Last alternative might be expressed as 'atoms change from fixed positions to them being able to slide around each other'.

Ignore any references to changes in separation.

OR

breaks some of the (atomic) bonds

OR

crystalline to amorphous ✔ (owtte)

An explanation that involves increasing the kinetic energy will lose the mark.

So will any description that implies it becomes a gas.

1

(c) The (total or mean) kinetic energy remains constant. ✔
The (total or mean) potential energy increases. ✔

2

(d) The <u>mean</u> speed/<u>mean</u> kinetic energy increases ✔

Ignore references to larger separation (because it's not always true): collisions (as it is not a gas) or measures of randomness (which are usually too vague).

Condone use of average for mean.

Don't allow velocity instead of speed.

During this time interval the atoms are all in the liquid form so no credit for references that indicate a change of state.

1

(e) Using both $\Delta Q = mc\Delta\theta$ **and** $\Delta Q = P\Delta t$ ✔

$$\left(c = \frac{P\Delta t}{m\Delta\theta} = \frac{35 \times (14.8 - 11.2) \times 60}{0.25 \times (110 - 28)} = 369\right)$$

c = 370 ✔ (allow 365–375)

J kg^{-1} K^{-1} ✔ (or J kg^{-1} C^{-1})

First mark can be given by seeing the substitution which may have some errors for example not using exactly 28. These will be penalised in the second mark.

Correct answer gains first two marks NB 400 J kg^{-1} K^{-1} shows candidate has wrongly made calculations for the solid. No mark for the unit if a solidus is used because of the uncertainty of whether the K is on the top or bottom line. (which is correct J / kg / K or J / kg K ?) However allow a prefix if kilojoules are used for example.

3

(f) (Using both $\Delta Q = ml$ and $\Delta Q = P\Delta t$)

$$l\left(=\frac{P\Delta t}{m}\right) = \frac{35 \times ((11.2-1.8) \times 60)}{0.25} = 79 \text{ kJ kg}^{-1}$$ ✓

hence M = gallium ✔ (condone an ecf consistent with the calculation provided a comment is made if the value falls outside the range of the table)

The calculation yields1.3 kJ kg^{-1} if the 60 seconds is omitted.

Interim stage heat supplied = 19.7 kJ

A valid calculation must be shown to gain this second mark.

2

[10]