Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Thermodynamics

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Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) Not possible to prevent some dissolving

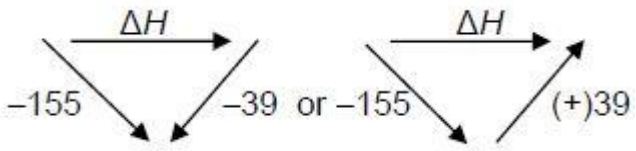
ALLOW It is soluble / dissolves / other hydrates may form / suggestions related to difficulty of measuring T (change) of a solid

1

(b) ($\Delta_{hyd}H$ =) –155 – (–39)

OR labelled cycle

Minimum needed for 'labelled cycle'



1

–116 (kJ mol^{-1})

1/2 for (+)116 or for –29 or for seeing –116 that has then be processed further

1

(c) This question is marked using levels of response. Refer to the Mark Scheme Instructions for examiners for guidance on how to mark this question

Level 3 (5 – 6 marks)

All stages are covered and the explanation of each stage is correct and virtually complete. Stage 2 must include use of a graphical method for Level 3 (i.e. 'highest T reached' method is max Level 2)

Answer communicates the whole explanation, including reference to enthalpy, coherently and shows a logical progression through all three stages.Answer is full and detailed and is supported by an appropriate range of relevant points such as those given below:
For the answer to be coherent there must be some indication of **how** the graph is used to find ΔT

Level 2 (3 – 4 marks)

All stages are covered (NB 'covered' means min 2 from each of stage 1 and 3) but the explanation of each stage may be incomplete or may contain inaccuracies
OR two stages covered and the explanations are generally correct and virtually complete

Answer is coherent and shows some progression through all three stages. Some steps in each stage may be out of order and incomplete

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Level 1 (1 – 2 marks)

Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies
OR only one stage is covered but the explanation is generally correct and virtually complete

Answer shows some progression between two stages

Level 0 (0 marks)

Insufficient correct Chemistry to warrant a mark

Indicative Chemistry Content

Stage 1 Method

(1a) Measures water with named appropriate apparatus
(1b) Suitable volume/mass / volume/mass in range 10 – 200 cm^3/g
(1c) Into insulated container / polystyrene cup (NOT just 'lid')
(1d) Add known mass of $MgCl_2(s)$
(1e) Use of 'before and after' weighing method. NOT 'added with washings'

Stage 2 Measurements (could mark from diagram)

(2a) Record initial temperature (min 2 measurements)
(2b) Record T at regular timed intervals for 5+ mins / until trend seen
(2c) Plot T vs time

Stage 3 Use of Results (3a and 3b could come from diagram)

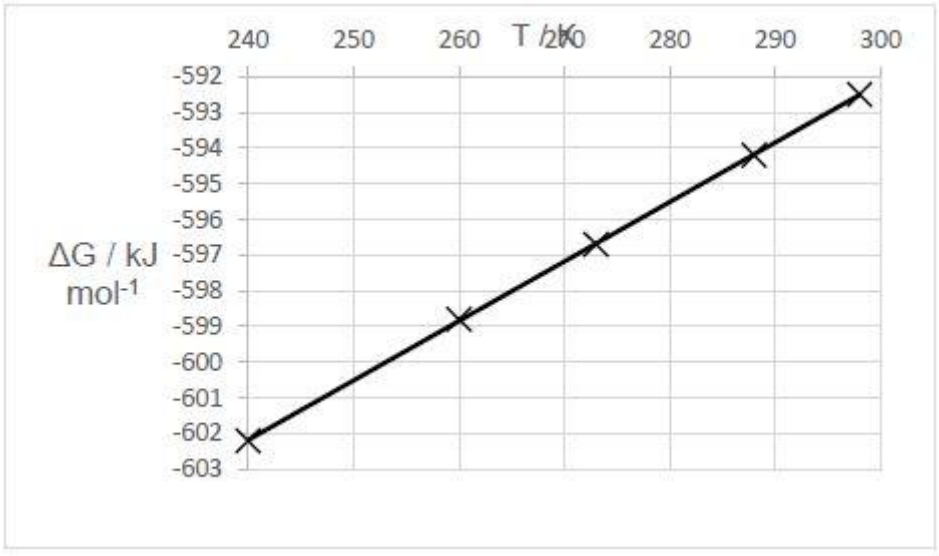
(3a) Extrapolate lines to when solid added (to find initial and final T)
(3b) $T_{final} - T_{initial} = \Delta T$ / idea of finding ΔT from graph at point of addition
(3c) $q = mc\Delta T$
(3d) amount = mass/Mr ($0.80/95.3 = 8.39 \times 10^{-3}$ mol)
(3e) $\Delta H_{soln} = -q/8.39 \times 10^{-3}$ or in words

This could all be described in words without showing actual calculations but describing stages

If method based on 'combustion' Max Level 1

6

(d)



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***M1** = 5 points correctly plotted*

***M2** = line drawn correctly (NOT if curved, doubled or kinked)*

(Check line of best fit –

*if through 250, -600.5 and 280, -595.5 +/- one small square then award **M2**, if all crosses on line award **M1** as well)*

2

Gradient = $\Delta(\Delta G)/\Delta T$ = 0.167 (kJ K^{-1} mol^{-1})

1

($\Delta G = \Delta H - T\Delta S$ so gradient = $-\Delta S$)

ΔS = –167 (J K^{-1} mol^{-1})

***M4** = unit conversion i.e. **M3** × 1000; M5 = –sign (process marks)*

*Correct answer with sign gets **M3**, **M4** and M5*

ALLOW –163 to –171

1+1

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Q2.

C

[1]

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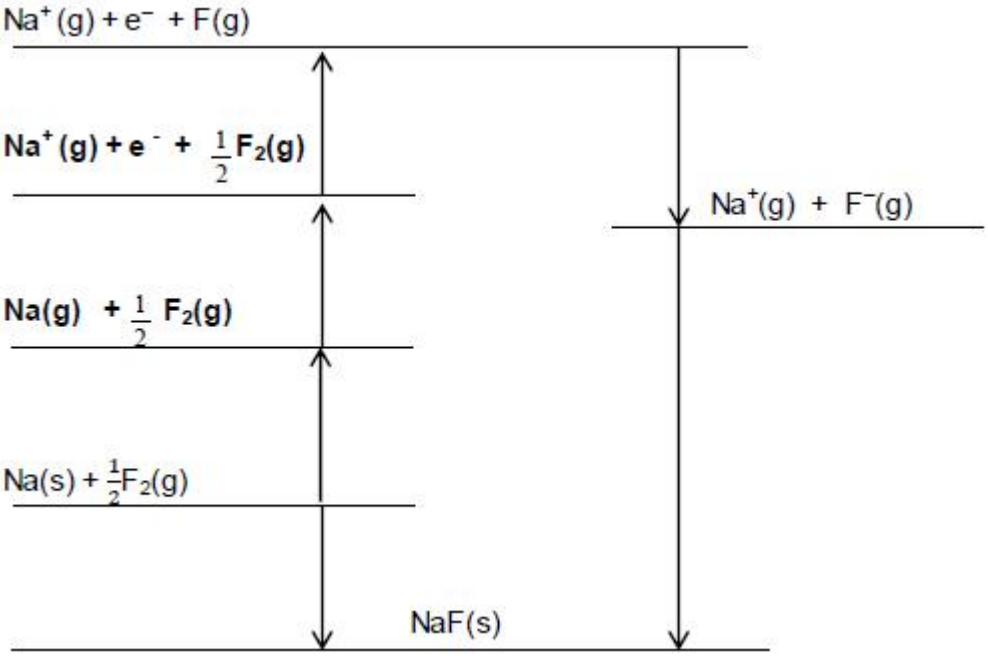
Q3.

(a)



or

M2 Na(g) + F(g)

M1 Na(s) + F(g)

or

M2 = Na(g) + F(g)

M1 = Na(g) + 0.5F_2(g)

2

(b) LE = −109 − 494 − 158/2 + 348 − 569

1

= −903 (kJ mol^{-1})

1

(c) NaCl enthalpy of lattice formation will be less negative **OR** less exothermic

1

Cl^- ion bigger (than F^-)

1

So attraction of halide ion to Na^+ is weaker

Allow so ionic bonding is stronger

1

(d) Amount of NaF = 1/42 = 2.38 × 10^{-2} mol

1

Amount of F_2 = (2.38 × 10^{-2})/2 = 1.19 × 10^{-2} mol

1

V = *nRT*/*p* = (1.19 × 10^{-2} × 8.31 × 298)/100000

1

V = 2.95 × 10^{-4} m^3

= 295 cm^3

1

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