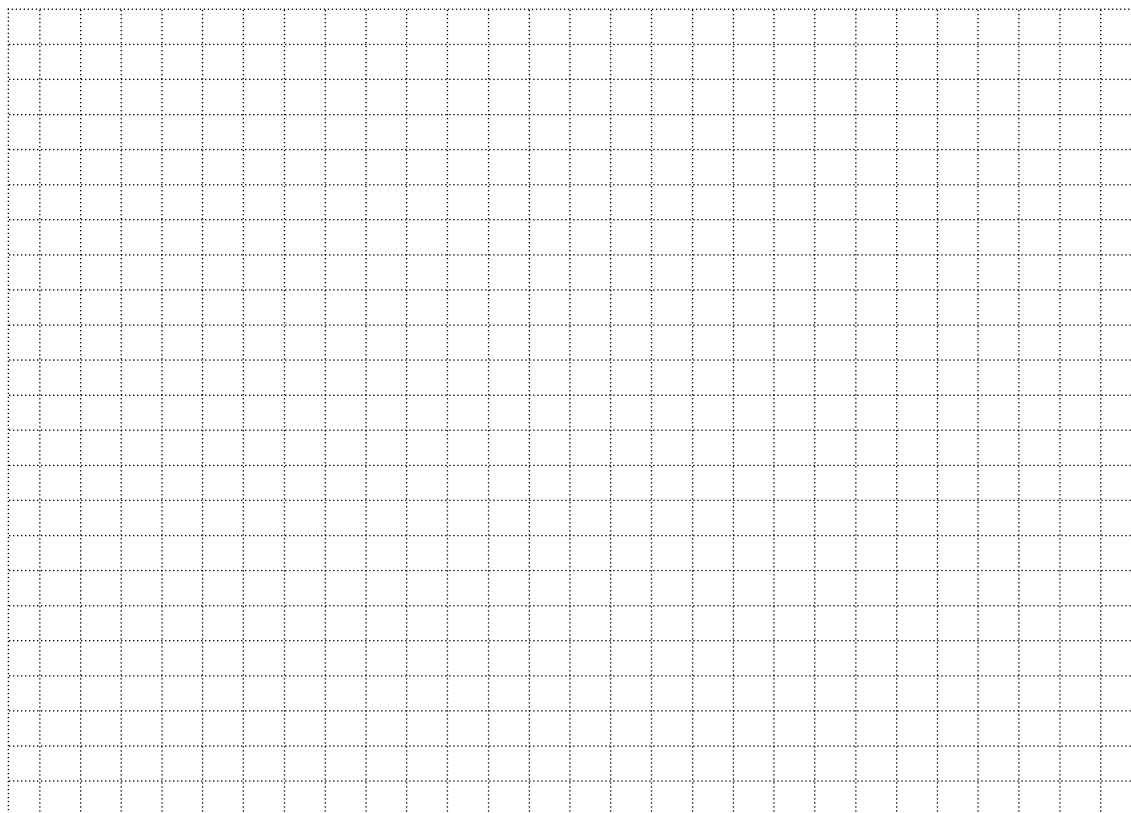**(10 marks)**

Port Pirie in South Australia is the location of one of the world's largest primary lead smelters and the third largest silver producer that has been in continuous operation since 1889. Over this time airborne lead-contaminated dust produced during smelting operations has been transported by wind and deposited throughout the city and in houses and on properties. A Chemist analyses several water samples containing lead sulfide from various locations around Port Pirie to determine the mass of sulfur and lead present. The results are below:

Sample Number	Mass of lead (g)	Mass of Sulfur (g)
1	2.07	0.321
2	4.06	0.713
3	3.45	0.534
4	2.30	0.356
5	4.14	0.641
6	2.59	0.401
7	?	0.620

(a)   Plot the first six results, plotting mass of lead against mass of sulfur.
(Spare grid on page 36)   (5 marks)

(b)   Use the graph to predict the mass of lead in sample 7.

(c)   Based on the experimental data determine the molar ratio of lead to sulfur and hence the formula.

_____

_____

_____

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_____

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_____

(3 marks)

(d)   On the basis of the formula that you have determined, what is the valency of the lead ion.?
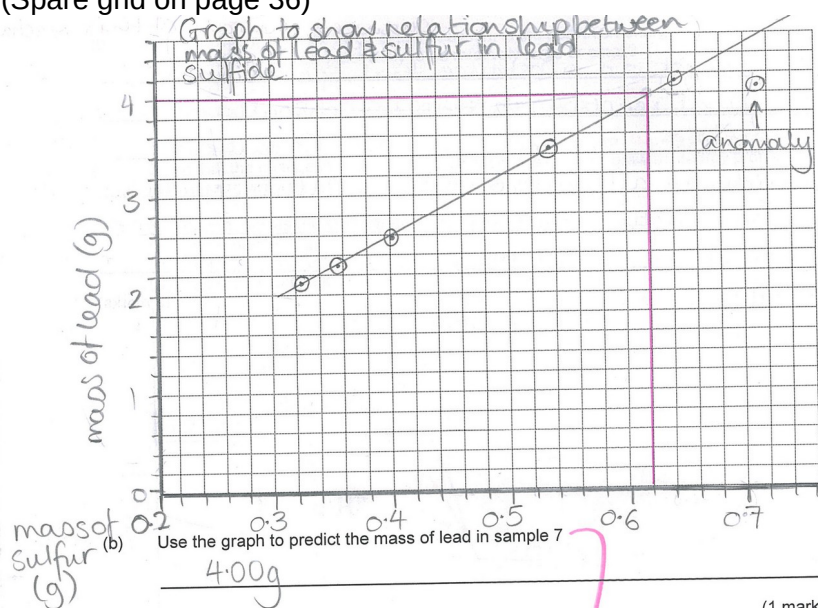
_____

(1 mark)

ANSWER
(10 marks)

Port Pirie in South Australia is the location of one of the world's largest primary lead smelters and the third largest silver producer that has been in continuous operation since 1889. Over this time airborne lead-contaminated dust produced during smelting operations has been transported by wind and deposited throughout the city and in houses and on properties.

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(e)   Plot the first six results, plotting mass of lead against mass of sufur.
        (Spare grid on page 36)   (5 marks)

Graph to show relationship between mass of lead & sulfur in lead sulfide

anomaly

mass of lead (g)

maos of Sulfur (g)

(b) Use the graph to predict the mass of lead in sample 7

4.00g

(1 mark)

Description	Marks
X axis: labelled with mass of sulphur, units, clear & useful scale	1
Y axis: labelled with mass of lead, units, clear & useful scale	1
Points plotted accurately	1
Straight line of best fit, drawn with ruler, leaving out the anomaly (last point)	1

Title that describes graph clearly	1
Lose 1 mark if axes wrong way round	

(f)   Use the graph to predict the mass of lead in sample 7.

Description	Marks
4.00 grams ± 0.05	1

(g)   Based on the experimental data determine the molar ratio of lead to sulfur and hence the formula.

Using any pair of values – This solution, massof lead 2.07 g and mass of sulfur 0.321 g

Moles of lead = $\dfrac{2.07}{207.2}$ = 9.93 x 10^{-3} mol

Moles of sulfur = $\dfrac{0.321}{32.07}$ = 1.00 x 10^{-2} mol

Mole ratio Pb to S = 9.93 x 10^{-3} : 1.00 x 10^{-2} = 1 : 1.007 ≈ 1:1

Formula PbS

Description	Marks
Calculation of moles of Pb and S	1
Mole ratio calculation	1
Formula PbS	1
To be awarded full marks a mole ratio calculation need to be shown	
Total	3

(h)   On the basis of the formula that you have determined, what is the valency of the lead ion.?

Description	Marks
+2 or 2+ not 2	1