

## **Examination**

### ***“Chemical Material Technology – Syntheses Techniques”***

**Date: February 08<sup>th</sup>, 2013**

**Max. 50 Points**

**Name, Given name:**

**Matrikel number:**

**Please only use these sheets (you might also use the reverse)!**

**Task 1)**

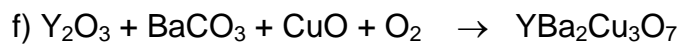
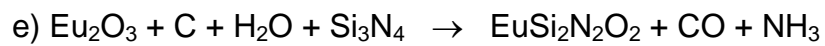
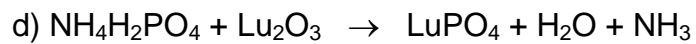
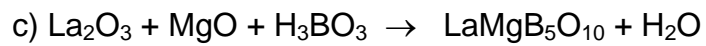
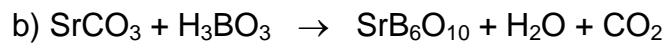
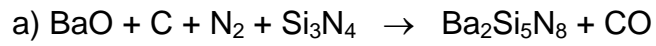
**(8 Points)**

#### **Solid State Chemistry**

- a) Name the basic physical mechanism of solid state reactions and give an example of a typical solid state reaction! (2 Points)
- b) Explain the role of defects in solid state reactions! (2 Points)
- c) By which measure one can enhance the ion conductivity in the product phase of a solid state reaction to accelerate the overall reaction speed? (2 Points)
- d) Sketch the defect density of an arbitrary solid state compound as function of temperature between 0 K and the melting point and mention the consequences for the choice of the reaction temperature! (2 Points)

**Task 2)****(6 Points)****Solid State Reactions**

Balance the following reaction equations! (each 1 Point)



**Task 3)****(8 Points)****Sol-Gel Chemistry**

- a) Explain the expressions “Sol” and “Gel”! (2 Points)
- b) Sort the following compounds according to the speed of hydrolysis  $Y(OCH_3)_3$ ,  $Y(OC_2H_5)_3$ ,  $Y(OC_3H_7)_3$ ,  $Y(OC_4H_9)_3$  and explain your choice! (2 Points)
- c) Describe the hydrolysis of tetramethylorthosilicate in an acidic medium! (2 Points)
- d) Describe the hydrolysis of tetramethylorthosilicate in an alkaline medium! (2 Points)

**Task 4)****(8 Points)****Chemical Transport Reactions**

- a) Please sketch the basic steps of a chemical transport reaction! (2 Points)
- b) What is the driving force for a chemical transport reaction? (2 Points)
- c) Please give two examples for a chemical transport reaction including the respective reaction equations! (4 Points)

**Task 5)****(12 Points)****Inorganic Luminescent Pigments**

a) Name a reaction to synthesis the following inorganic luminescent pigments! (1 Point each)

CaS:Eu

Y<sub>2</sub>O<sub>3</sub>:Eu

Y<sub>3</sub>Al<sub>5</sub>O<sub>12</sub>:Ce

LaPO<sub>4</sub>:Ce

BaSi<sub>2</sub>O<sub>5</sub>:Pb

b) Please mention for each of the aforementioned pigments a potential degradation mechanism! (1 Point each)

c) Mention a method to stabilise these pigments! (2 Points)

**Task 6)**

**(8 Points)**

**Nanoscale Inorganic Pigments**

Give two methods

a) to synthesis nanoscale pigments (2 Points)

b) to stabilise nanoscale pigments in aqueous solution (2 Points)

c) to determine the particle size distribution of nanoscale particles (2 Points)

d) to separate nanoscale from microscale particles! (2 Points)