



UNIVERSITY
OF
JOHANNESBURG

RETHINK. REINVENT.

UNIVERSITY OF JOHANNESBURG

DEPARTMENT OF CHEMICAL ENGINEERING TECHNOLOGY

PROGRAM : NATIONAL DIPLOMA

SUBJECT : CHEMICAL PROCESS INDUSTRIES

CODE : WPD2111

DATE : JUNE FINAL EXAMINATION - 18 JUNE 2014

DURATION : 3HRs 00MIN

TOTAL MARKS : 175

FULL MARKS : 160

EXAMINER : MR. M BELAID & DR. T SEODIGENG

MODERATOR : MR. MOLLAGEE

NUMBER OF QUESTIONS : 7

NUMBER OF PAGES : 5 (INCLUDING THIS COVER PAGE)

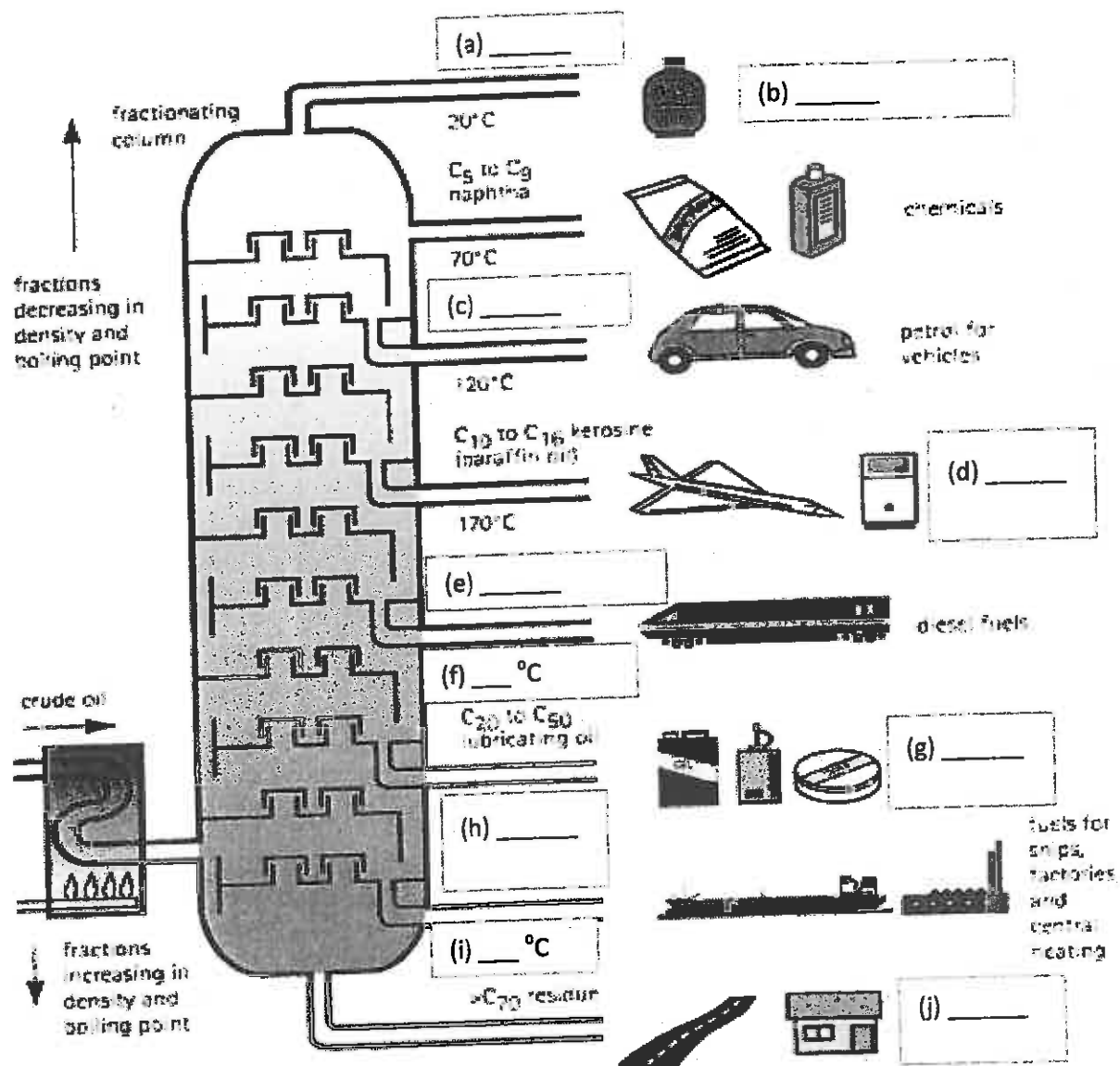
INSTRUCTIONS :

- EXAMINATION RULES FOR THE UNIVERSITY OF JOHANNESBURG APPLY
- ANSWER ALL QUESTION
- CALCULATORS ARE ALLOWED

QUESTION 1: PETROLEUM REFINING

[25]

- 1.1 Complete the following diagram by supplying the missing molecular/carbon chain length number ranges, temperature, products and/or uses. [10]



- 1.2 List eight (8) processing steps of the petroleum refining process. [8]
- 1.3 What is Cracking in Petroleum Refining? List three (3) types of cracking processes. [7]

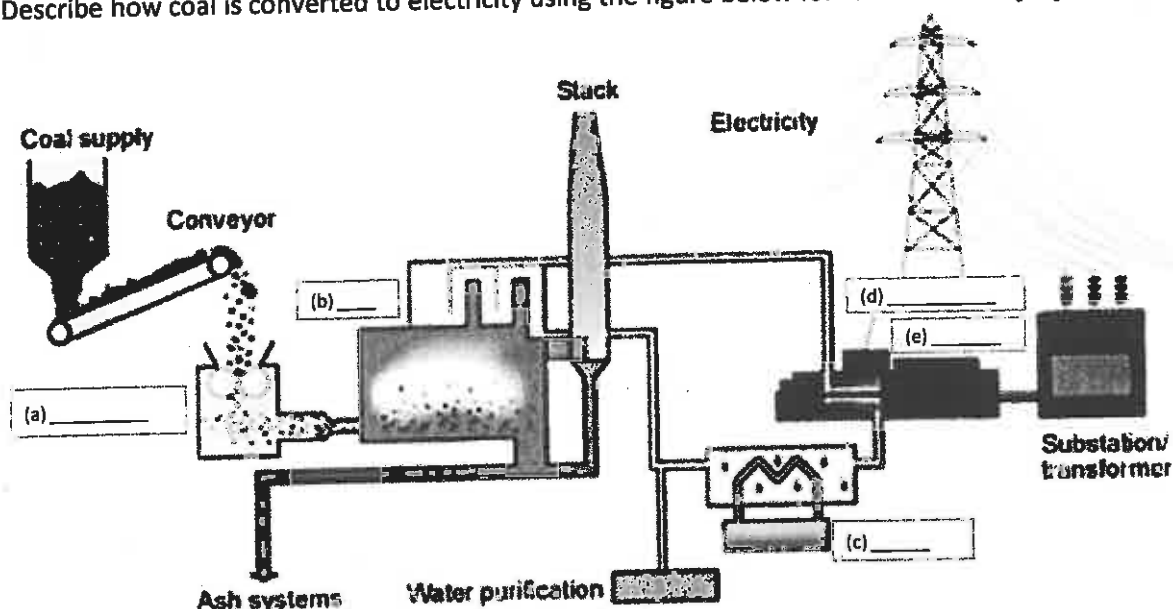
QUESTION 2: COAL**[25]**

2.1 Supply missing information in the coal characteristic table below.

[10]

| Type of Coal | Fixed Carbon content [%] | Calorific Value [BTU] | Moisture content [%] | Uses/mining characteristics |
|--------------|--------------------------|-----------------------|----------------------|------------------------------|
| (a) _____ | 45 – 86% | (b) _____ | 2 - 15 % | metallurgy, coke |
| Anthracite | 86 – 98% | (c) _____ | (d) _____ | Deep mining, lowest reserves |
| Lignite | (e) _____ | 4000 - 8300 | 10 - 25 % | (f) _____ |
| (g) _____ | (h) _____ | 8300 - 13000 | (i) _____ | (j) _____ |

2.2 Describe how coal is converted to electricity using the figure below for reference.

[10]

2.3 Supply the missing information in the figure above as indicated by (a) – (e).

[5]**QUESTION 3: IRON AND STEEL****[20]**

3.1. Describe how steel is formed from ore Fe_2O_3 . Draw a block flow diagram of pig iron making from ore in a blast furnace. List all input materials. List all major balanced chemical reactions that occur in the reduction process.

[15]

3.2. Describe the effects of the following elements in steel

- a) Carbon
- b) Nickel

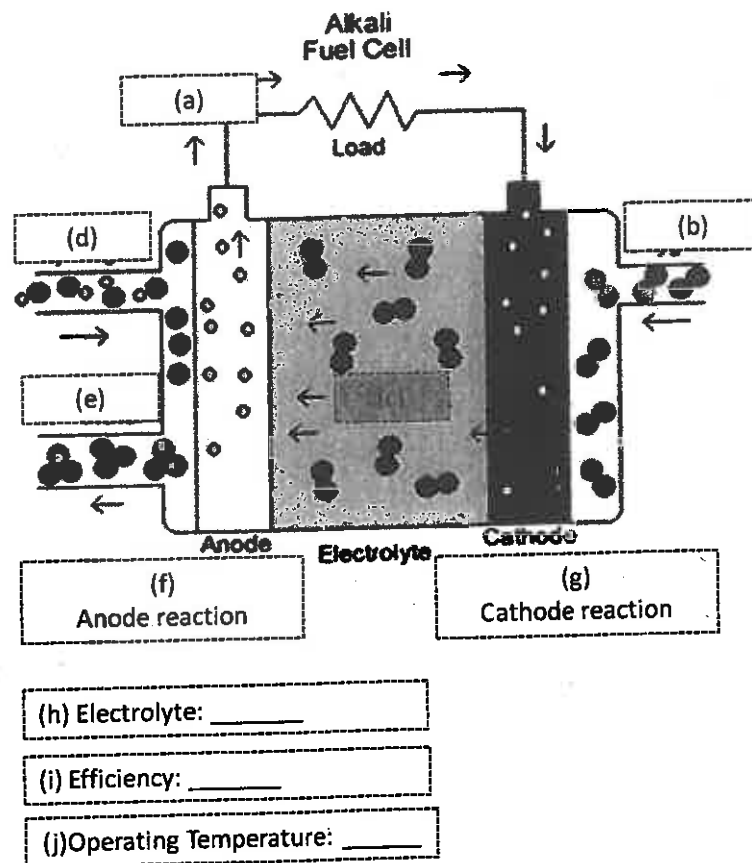
- c) Tungsten
- d) Copper
- e) Chromium

[5]

QUESTION 4: FUEL CELLS

[20]

4.1 Considering the operating principles of an Alkali fuel cell, supply the missing information in the figure below as indicated by (a) – (j). [12]



4.2 Discuss how hydrogen is made for coal. Give two main balanced chemical reactions and combine them to make the overall balanced chemical reaction. [8]

QUESTION 5:

[25]

Discuss the following:

- 5.1. The major steps of soap production of the Lever Rexona process. (6)
- 5.2. The two types of detergents production processes: (4)
- 5.2.1 Typical post dosing ingredients. (8)
- 5.2.2 The environmental implication of soap production. (7)

QUESTION 6:**[35]**

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- 6.1 Discuss the production of sulfuric and nitric acid and their role in their fertiliser industry (15)
- 6.2 Discuss the production of the superphosphate fertilisers (8)
- 6.3 Discuss the role of the kiln in the cement production (5)
- 6.4. What are the environmental issues associated with Cement production, provide ways to deal with these issues, use examples to illustrate your answers. (7)
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QUESTION 7:**[25]**

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- 7.1 Discuss the motivation and driving factors with regard to cleaner production and waste minimization (5)
- 7.2 Discuss the possible causes of waste generation (5)
- 7.3 Benefits of cleaner production (5)
- 7.4 Discuss environmental issues tackled by cleaner production (5)
- 7.5 Draw the block diagram of cleaner production assessment practice (5)
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