higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1290**(E)**(A2)T

NATIONAL CERTIFICATE

PLANT OPERATION THEORY N1

(11040001)

2 August 2019 (X-Paper)
09:00–12:00

This question paper consists of 6 pages and 1 formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
PLANT OPERATION THEORY N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Sketches must be large, neat and fully labelled.
5. Work neatly.

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QUESTION 1: CHEMISTRY

1.1 Define each of the following terms:

1.1.1 Atomic number

1.1.2 Molecule

1.1.3 Atom

1.1.4 Mass number

1.1.5 Anions

(5 × 2) (10)

1.2 Complete and balance each of the following reactions:

1.2.1 $K + H_2O \rightarrow$

1.2.2 $Zn + H_2SO_4 \rightarrow$

1.2.3 $NH_3 + H_2SO_4 \rightarrow$

(3 × 2) (6)

1.3 Draw the structure of ethylene. (4)

[20]

QUESTION 2: VALVES AND PIPES

2.1 Give the function and an advantage or disadvantage of each of the following:

2.1.1 Ball valve

2.1.2 Gate valve

2.1.3 Nonreturn valve

(3 × 2) (6)

2.2 Name SIX parts of which valves consist. (6)

2.3 Define each of the following terms:

2.3.1 Temperature

2.3.2 Pressure

2.3.3 Vacuum

2.3.4 Flow

(4 × 2) (8)

[20]

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QUESTION 3: PUMPS AND INSTRUMENTATION

3.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (3.1.1–3.1.5) in the ANSWER BOOK.

3.1.1 Pump supply pressure is one of the aspects that determine the power supply.

3.1.2 The suction head refers to the vertical height concerning a pipe.

3.1.3 Flow is the quantity of fluid in a pipe.

3.1.4 A safety valve is not necessary for all pipes.

3.1.5 An open valve impeller is not suitable for handling liquid containing solids.

(5 × 1) (5)

3.2. Use a labelled sketch of a sectional view of a turbine pump to explain its operation. (6)

3.3 State SEVEN aspects which should be considered when operating a pump. (7)

3.4 Name TWO types of centrifugal pumps. (2)

[20]

QUESTION 4: DISTILLATION AND WATER TREATMENT

4.1 Heat is a form of energy that can be transferred from one object to another.

List THREE ways in which heat can be transferred. (3)

4.2 Explain each of the following terms:

4.2.1 Conversion of energy (3)

4.2.2 Exchange (2)

4.2.3 Conserve (2)

4.3 Explain the difference between *soft* and *distilled* water and state the use of each. (6)

4.4 Give FOUR main salts that cause permanent hardness of water. (4)

[20]

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QUESTION 5: SAFETY AND STORAGE

5.1 Draw a neat, labelled sketch of the underground storage of light hydrocarbons. (10)

5.2 State TWO elements needed to start and sustain a fire. (2)

5.3 Briefly describe each of the following types of fire and also state how each can be distinguished:

5.3.1 Class A

5.3.2 Class B

5.3.3 Class C

5.3.4 Class D

(4 × 2) (8)
[20]

TOTAL: 100

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PLANT OPERATION THEORY N1

FORMULA SHEET

Any other applicable formula may be used.

1. $\rho = \frac{p}{gh}$
2. $V = \ell bh$
3. $V = \pi \frac{d^3}{6}$
4. $V = 4\pi \frac{r^3}{3}$
5. $V = x\left(\frac{\pi d^2 h}{12} + V_1\right)$
6. $\Delta P = \rho gh$
7. $V = \pi \frac{d^2}{4} \times h$
8. $\rho = \frac{F}{A}$
9. $A = \pi d^2$
10. $A = \pi \frac{d^2}{4} = \pi r^2$
11. $A = 4\pi r^2$
12. $R = \frac{output}{input} \times 100\%$
13. $\rho_1 gh = \rho_2 gh$
14. $Q = Av = C$
15. $k = \frac{Q}{\sqrt{h}}$
16. $E = \frac{mv^2}{2}$
17. $E = mgh$
18. $V = \pi DN$
19. $V = \frac{a}{t}$
20. $V = \sqrt{2gh}$
21. $PA = mg$
22. $h_{su} = m\{(h_f + gh_{fg}) + C_s(t_{su} - t_s) - (C_w \times t_w)\}$
23. $m = \rho v$
24. $A = \frac{F}{p}$
25. $K = \frac{mv^2}{2}$
26. $K = W/m^2K$
27. $Pv = cT$
28. $m = \frac{Pv}{RT}$
29. $n = \frac{Pv}{R_0 T}$
30. $V = A\ell NnR$
31. $K = \frac{Qx}{A\Delta t}$

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