THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY (DSLT 10S)

APS 2202: PHYSICS TECHNIQUE II

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2012
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question One (30 marks)

a) What is meant by "Thermodynamic cycles" **(2 marks)**

b) The diagram represents a pressure-volume relationship for a Carnot's Cycle

Figure 1

If the working substance is at initial state A:

i) Name the processes AB, BC, CD and DA **(4 marks)**

ii) Explain how the work done by working substance can be obtained from the graph. **(2 marks)**

iii) Why is the temperature increasing from state D to A **(2 marks)**

c) A Carnot engine whose low-temperature reservoir is 280K has an efficiency of 40%. By how much must the temperature of the Higher-Temperature reservoir be raised if the efficiency is to be increased to 50%, the temperature of the low-temperature reservoir being unchanged? **(5 marks)**

d) Explain **TWO** methods of Desalination **(4 marks)**

e) An ideal gas with a volume of $0.1m^3$ expands at the constant pressure of 1.5×10^5 pa to treble its volume. Calculate the work done by gas **(3 marks)**

f) Outline **FIVE** points considered when identifying storage area for compressed gas used in the laboratory. **(5 marks)**

g) Give **THREE** applications when Gas compressors are used. **(3 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two (20 marks)

a) (i) State **THREE** methods of water lifting. **(3 marks)**

(ii) A tank of dimensions 1m by 1.2m and height 1.5m is filled in a day by a pump operating at an average efficiency of 12%. The tank is on the roof of a laboratory which is 15m above the ground. Determining the daily energy requirement in MJ. **(7 marks)**

b) Explain **THREE** uses of water in Health Facilities **(6 marks)**

c) (i) What is meant by "isobaric change" **(1 mark)**

(ii) A Carnot engine operates between two reservoirs at 300k and 400k. What is the efficiency of the cycle? **(3 marks)**

Question Three (20 marks)

a) An ideal gas, initially at 30°C and 100Kpa, undergoes an internally reversible, cyclic process in a closed system. The gas is first compressed adiabatically to 500Kpa, then cooled at a constant pressure of 500Kpa, then cooled at a constant pressure of 500Kpa to 30°C and finally expanded isothermally to its original state.

(i) Sketch the process path for this cycle on a PV diagram **(5 marks)**

(ii) Calculate the temperature, T2 at the end of the first stage of compression, $\gamma = 1.4$. **(3 marks)**

b) (i) List **FIVE** types of Gases **(5 marks)**

(ii) Describe briefly the distribution system of Gas used for heating in the laboratory.

c) Explain **TWO** sources of water **(4 marks)**

Question Four (20 marks)

a) Most car engines are four-stroke petrol engines:

(i) Name the **FOUR** strokes, in the correct sequence **(4 marks)**

(ii) Explain why the engines are reference to as internal combustion engine. **(2 marks)**

(iii) How many times does the crank shaft revolve during the four strokes? **(1 mark)**

b) A pump system for lifting water is rated at 4.9KW. It is required to raise water to a height of 10M at a flow rate of 5 litre/sec. Calculate the overall efficiency of the system. **(3 marks)**

c) (i) State **THREE** examples of flammable gases **(3 marks)**

(ii) Explain how hazardous gas cylinders are stored **(2 marks)**

d) A mass of air with an initial volume of 5litres at a temperature of O°C and a pressure of 10^5Pa in compressed isothermally to 2.5 litres and then allowed to expand adiabatically to 12.5 litres, finally its compressed to its initial volume of 5 litres.

(i) Show the process on a P-V diagram **(4 marks)**

(ii) What type of change is the gas undergoing during the last stage of the cycle? **(1 mark)**

Question Five (20 marks)

a) (i) Explain the principle behind the working of a compressor. **(2 marks)**

(ii) What is meant by "clearance volume" **(2 marks)**

b) Describe the comparison cycle for practical compressor by drawing a P-V diagram and explain each process. **(8 marks)**

c) An ideal gas at 27°C and a pressure of 760mm of mercury is compressed isothermally until its volume is halved. It is then expanded reversible and adiabatically to twice it's original volume. If the value of γ for the gas is 1.4, calculate the final pressure and temperature of the gas. **(8 marks)**