Marine Engineer Class 3/4

Marine Engineering Thermodynamics Mock Test

Date: **08th March 2019**

Time: **1030 hours**

Time Allowed: **120 minutes (5 minutes extra for reading the examination paper)**

Pass Marks: **33 out of 55**

Weighting: **50% of final Applied Thermodynamics grade**

Number of Questions: **All Questions are compulsory**

Instructions:

1) **Do not start writing until you are told to do so by the Supervisor**
2) **Candidates may bring drawing instruments and non-programmable calculators to the examination.**
3) **All written answers must be in ink.**
4) **Drawings can be done in pencil.**
5) **ALL working must be shown for full marks to be given**

NO ***CELLPHONES / SMARTWATCHES*** ARE PERMITTED IN THE EXAMINATION ROOM

Question 1 **Total: 11 Marks**

(i) An iron ingot of 4kg at 400 ^{0}C, is placed in 6kg of water at 60 ^{0}C, after some time an equilibrium temperature is reached. Calculate the equilibrium temperature in degree centigrade.

Assume no heat loss to the surrounds.

Round your answer to 1 decimal place. ***(6 Marks)***

(ii) How many kilograms of copper can be raised from 25°C to 90°C by the absorption of 100 kJ of heat energy? (Use data sheet for specific heat capacity)

(5 Marks)

Question 2 **Total: 8 marks**

A solid cast iron sphere is 165mm diameter. If 2300 KJ of heat energy is transferred to it, find the increase in diameter in millimetres, taking the following values for cast iron;

Density = 7.19 g/cm3

Specific heat capacity = 0.54 KJ/kgK

Volume of Sphere = $\frac{4}{3}\pi r^3$

Question 3 **Total: 4 marks**

A steel pipe has a length of 3.2m at ambient temperature of 25 ^{0}C. It carries steam at a temperature of 210 ^{0}C. What will be the increase in length of the pipe in millimetres?

Round your answer to 2 decimal places.

Question 4 **Total: 5 marks**

A cold storage compartment at 4^0C has a rectangular door of 200 mm thickness containing air. The door measures 2.0m by 0.9m and the outside temperature is 32˚C

a) Calculate the total heat loss through the door in one hour.

b) Calculate the rate of heat loss through the door

Question 5 **Total: 20 marks**

(i) Calculate the heat which must be added to 3 kg of water at 30^0C to form 3 kg of superheated steam at a pressure of 600 KN/m^2 and temperature 250^0C.

Take the specific heat capacity of superheated steam as 2 KJ/kg K and

Specific heat capacity of water as 4.2 KJ/kg K

(12 Marks)

(ii) 8 kg of steam 72 percent dry at an initial pressure of 700 KN/m^2 suffers a rapid fall in pressure to 150 KN/m^2. Calculate the final dryness of the steam, assuming that there is no change in enthalpy of the steam.

(8 Marks)

Question 6 **Total: 7 marks**

(a) State the First Law of Thermodynamics (***2 Marks)***

(b) Heat energy is transferred to 1.52kg of air, which causes its temperature to increase from 38^0C to 388^0C. Calculate, the following at a Constant volume applying the 1^{st} law of thermodynamics ,

i. The quantity of heat energy transferred
ii. The external work done
iii. The increase in internal energy

(Use data sheet for Specific heat at constant volume for air) ***(5 Marks)***