**ME 322 HOMEWORK #32
(MOCK EXAM #3)**

**Mark all correct answers. Supply supporting reasoning if you feel it is necessary.
Document all equations, conversions, and tables used in finding answers to quantitative problems.**

1- What are the fundamental units of the heat rate (Btu/kw-hr) in the force-length-time (FLT) system?
a) FL/t
b) L2/t2
c) FL2/t3
d) none

2- What is the correct definition of moisture in the two phase region?
a) volume fraction of saturated liquid
b) volume fraction of saturated vapor
c) mass fraction of saturated liquid
d) mass fraction of saturated vapor

3- What process condition(s) apply to an ideal compressor?
a) Isobaric
b) Aergonic
c) Isenthalpic
d) Isentropic

4- What process condition(s) apply when modeling a condenser?
a) Isobaric
b) Aergonic
c) Isenthalpic
d) Isentropic

5- Which of the following statements are true along an isotherm on a P-h diagram?
a) Lines slope from upper left to lower right in single phase regions.
b) Lines slope from lower left to upper right in single phase regions.
c) Lines are vertical in the two phase region.
d) Lines are horizontal in the two phase region.

6- How much compression work is required to reduce the volume of 1 kg of air a 0 C and 1 atmosphere by one-half under isothermal conditions?
a) 43 kJ
b) 53 kJ
c) 63 kJ
d) 73 kJ

**Questions 7-11 consider the reheat cycle powerplant with state points in the array shown below. Assume a mass flow rate of 250,000 lbm/hr.**

7- What is the power input to the feedwater pump?
a) 500 hp
b) 550 hp
c) 600 hp
d) 650 hp

8 – What is the entropy production rate of the feedwater pump?
a) -125 Btu/hr-R
b) 0 Btu/hr-R
c) +125 Btu/hr-R
d) +250 Btu/hr-R

9 – What is the boiler duty for this plant?
a) 370,000,000 Btu/hr
b) 378,000,000 Btu/hr
c) 383,000,000 Btu/hr
d) 390,000,000 Btu/hr

10 – Most nearly, what is the backwork ratio of this plant?
a) 1.0%
b) 1.5%
c) 3.0%
d) 4.5%

11- Most nearly, what is the thermal efficiency of this plant?
a) 33%
b) 36.5%
c) 38%
d) 39.5%

12- What the temperature of fluid entering the compressor in an ammonia refrigeration cycle with
a DSH of 5 F, DSC of 3 F, an evaporator pressure of 16 psia, and a condenser pressure of 129 psia?
a) -25 F
b) -20 F
c) 67 F
d) 75 F

13 – What is the temperature of fluid entering the throttle valve in an ammonia refrigeration cycle with
a DSH of 5 F, DSC of 3 F, an evaporator pressure of 16 psia, and a condenser pressure of 129 psia?
a) -25 F
b) -20 F
c) 67 F
d) 75 F

**Problems 14-15 apply to an isentropic compressor where air enters at 80 F and increases from 14.5 psia to 111 psia.**
14 - What is the exit temperature? HINT: Use the air tables.
a) 300 F
b) 400 F
c) 500 F
d) 600 F

15 – What is the specific work input to this compressor?
a) 36 Btu/lbm
b) 73 Btu/lbm
c) 102 Btu/lbm
d) 139 Btu/lbm

16 – Which of the following thermodynamic processes apply to a brayton cycle?
a) isentropic compression
b) isochoric heat addition
c) isothermal expansion
d) isobaric heat rejection

**The following description applies to problems 17-18. An ideal gas at a pressure of 3.45 MPa and a temperature of 20 C is contained in a cylinder with a volume of 20 cubic meters. Enough gas is released to lower the pressure in the cylinder to 1.725 MPa. The expansion of the gas is isentropic. The specific heat ratio is 1.4 and the gas constant is 273 J/kg-K.**

17 – Most nearly, what is the initial mass of gas in the cylinder?
a) 560 kg
b) 660 kg
c) 760 kg
d) 860 kg

18 – Most nearly, what is the temperature of gas in the cylinder at the end of this process?
a) 160 K
b) 200 K
c) 240 K
d) 280 K

**The following description applies to problems 19-20. A mixture with total pressure of 300 kPa consists of 67% by volume hydrogen (H2) and 33% by volume oxygen (O2)**

19 - What is the partial pressure of oxygen?
a) 50 kPa
b) 100 kPa
c) 200 kPa
d) 300 kPa

20 – What is the mass fraction of oxygen?
a) .11
b) .33
c) .67
b) .89