PIPE

Find the work posses for a helium gas at 20C.

A. 609kj/kg
B. 168kj/kg
C. 229kj/kg
D. 339kj/kg

Two kilogram of gas is confined in a 1m^3 tank 200kpa and 88degC. What type of gas is in the tank?

A. Helium
B. Ethane
C. Methane
D. Ethane

Find the enthalpy of the helium if its internal energy is 200KJ/Kg.

A. 144 kj/kg
B. 223.42 KJ/kg
C. 333.42 KJ/kg
D. 168 KJ/kg

Compute the mass of a 2m^3 propane at 280 kpa and 40degC

A.6.47
B. 5.1
C. 10.20
D. 9.47

Compute the air flow in ft^3/min of mechanical ventilation required to exhaust an accumulation of refrigerant due to leaks of the system capable of revolving air from the machinery room for a mass of 4lbs refrigerant.

A. 200
B. 210
C. 220
D. 230

Compute the free aperture cross section in m^2 for the ventilation of a machinery room in the mass of refrigerant is 9kg.

A. 0.314
B. 0.414
C. 0.514
D. 0.614

A 29.53” X 39.37” pressure vessel contains ammonia with f=0.041. compute the minimum required discharge capacity of relief device in kg/hr.

A. 106.71 kg/hr
B. 108.7 kg/hr
C. 110.71 kg/hr
D. 112.71 kg/hr

Compute the maximum length of discharge pipe installed on the outlet of a pressure-relief device in feet for the internal pipe diameter of 0.5 inch and rated discharge capacity is 8lb/min of air. The rated pressure of relief valve is 16psig.

A. 0.286ft.
B. 0.386 ft.
C. 0.386 ft.
D. 0.586 ft

A thermal power plant has a heat rate of 11,363 Btu/kw-hr. find the thermal efficiency of the plant.

A. 28%
B. 30%
C. 34%
D. 40%

What is the hydraulic gradient of a 1 mile, 17 inches inside diameter pipe when 3300 gal/ml of water flow with f= .03?

A. 0.00714
B. 0.00614
C. 0.00234
D. 0.00187

Find the loss of head in the pipe entrance if speed of flow is 10 m/s.

A. 5.10m
B. 10.2m
C. 17.4m
D. 2.55m

Wet material containing 220% moisture (dry basis) is to be dried at the rate of 1.5 kg/s in a continuous dryer to give a product containing 10% (dry basis). Find the moisture removed, kg/hr.

A. 3543.75 kg/hr
B. 3513.75 kg/hr
C. 3563.75 kg/hr
D. 3593.75 kg/hr

Copra enters a dryer containing 70% moisture and leaves at 7% moisture. Find the moisture removed on each pound of solid in final product.

A. 6.528lb
B. 1.258lb
C. 4.258lb
D. 2.258 lb

A 1m x 1.5m cylindrical tank is full of oil with sg=0.92. find the force acting at the bottom of the tank in dynes

A. 106.33 x 10^3
B. 106.33 x 10^4
C. 106.33 x 10^5
D. 106.33 x 10^6

Find the pressure at 100 fathom depth of water in kpag.

A. 1,793.96 kpag
B. 1,893.96 kpag
C. 1,993.96 kpag
D. 1,693.96 kpag

Find the depth of furlong of the ocean (SG=1.03) if the pressure at the sea bed is 2,032.56 kpag.

A. 1
B. 2
C. 3
D. 4

Find the mass of 10 quartz of water

A. 10.46kg
B. 9.46kg
C. 11.6kg
D. 8.46kg

Find the mass of carbon dioxide having a pressure of 20 psia at 200F with 10ft^3 volume.

A. 1.04 lbs
B. 1.14 lbs
C. 1.24 lbs
D. 1.34 lbs

Find the heat needed to raise the temperature of water from 80^C to 100^C with 60% quality. Consider an atmospheric pressure of 101.325 kpa. Use the approximate enthalpy formula of liquid.

A. 293.09kj/kg
B. 1,772.90 kj/kg
C. 1,547.90 kj/kg
D. 1,647.29 kj/kg

Find the enthalpy of water 212F and 14.7 psi dryness for factor is 30% use the approximate enthalpy formula of liquid.

A. 461 Btu/lb
B. 471 Btu/lb
C. 481 Btu/lb
D. 491 btu/lb

An air compressor consumed 1200 kw-hr per day of energy. The electric motor driving the compressor has an efficiency of 80%. If indicated power of the compressor is 34kw. Find the mechanical efficiency of the compressor.

A. 117.65 %
B. 75%
C. 85%
D. 90%

Refrigeration system consumed 28,800 kw-hr per month of energy. There are 20% of energy is lost due to cooling system of compressor and motor efficiency is 90%. If the COP of the system is 6, find the tons of refrigeration of the system.

A. 43.15 TR
B. 46.15 TR
C. 49.15 TR
D. 41.15TR

23 Tons of refrigeration system has a heat rejected of 100kw. Find the energy efficiency ratio of the system.

A. 13.42
B. 14.42
C. 15.42
D. 16.42

A 200mm x 250mm 8 cylinder, 4-stroke diesel engine has a brake power of 150kw. The mechanical efficiency is 80%. If two cylinders were accidentally cut off what will be the new friction power?

A. 31.50 kw
B. 33.50 kw
C. 35.50 kw
D. 37.50 kw

The energy efficiency ratio of the refrigeration system is 12.6, what is the cop of the system?

A. 3.69
B. 4.23
C. 5.92
D. 6.83

An air compressor has a power of 40 kw at 4 % clearance. If the clearance will increase to 7% what is the new power?

A. 70 kw
B. 40 kw
C. 53 kw
D. 60 kw

What is the approximate value of temperature if water having enthalpy of 208 Btu/lb?

A. 138.87 deg C
B. 115.55 deg C
C. 258.67 deg C
D. 68.67deg C

Convert 750R to K

A. 390.33K
B. 395K
C. 410.33K
D. 416.33K

An otto cycle gas a compression of 8, find the pressure ratio during compression

A. 18.38
B. 16.38
C. 14.38
D. 16.38

A diesel cycle has a cut off ratio of 2.5 and expansion ratio of 4. Find the clearance of cycle.

A. 9.11%
B. 5.55%
C. 11.11%
D. 15.15%

A dual cycle has an initial temperature of 30C. the compression ratio is 6 and the heat addition at constant volume process is 600kj/kg. if cut off ratio is 2.5, find the maximum temperature of the cycle.

A. 3638.50 deg C
B. 3365.50 deg C
C. 3565.50 deg C
D. 3965.50 deg C

A three stages air compressor compresses air from 100kpa to 1000kpa. Find the intercooler pressure between the first and second stage.

A. 505.44kpa
B. 108.44kpa
C. 316.23kpa
D. 215.44kpa

A 10—stages air compressor compresses air from 100kpa to 800kpa. Find the intercooler pressure between the first and second stage.

A. 282.84 kpa
B. 113.21 kpa
C. 123.11 kpa
D. 333.51 kpa

A 3 stages air compressor compresses air from 100kpa to 700kpa. Find the intercooler pressure between 2nd and 3rd stage

A. 365.88 kpa
B. 375.88 kpa
C. 385.88 kpa
D. 395.88 kpa

Carnot cycle a,b,c are connected in series so that the heat rejected from a will be the heat added to B an heat rejected from b will be added to c. each cycle operates between 30degC and 400degC. If heat added to A is 1000kw, find the work output of C.

A. 111.44 kw
B. 549.78 kw
C. 247.53 kw
D. 141.89 kw

Air is compressed adiabatically from 30degC to 100degC. If mass of air being compressed is 5kg, Find the change of entropy?

A. 1.039 kj/kg
B. 0.746 kj/kg
C. 0
D. 1.245 kj/kg

Two kilogram of air in a rigid tank changes its temperature from 32degC to 150degC. Find the work done during the process.

A. 236
B. 170
C. 195
D. 0

Determine the atmospheric pressure at a location where barometric reading is 740mm Hg and gravitational acceleration is g = 9.7m/s^2. Assume the temperature of mercury to be 10 deg.C at which the density is 13,570 kg/m^3.

A. 99.45 kpa
B. 97.41 kpa
C. 95.44 Kpa
D. 98.66 Kpa

The barometer of a mountain hiker reads 930mbars at the beginning of a hiking reads 780 mbar at the end. Neglecting the effect of altitude on local gravitational acceleration, determine the vertical distance climbed. Assume g = 9.7 m/s^2.

A. 1275.21 m
B. 1289.00 m
C. 1267.34 m
D. 1583.34 m

The lower half of a 10 m high cylindrical container is filled with water and upper half with oil that has SG= 0.85. determine the pressure difference between the top and bottom of the cylinder.

A. 90.74 Kpa
B. 92.74 Kpa
C. 83.38 Kpa
D. 98.10 Kpa

An ideal gas at 0.80 atmosphere and 87degC occupies 0.450 liter. How many moles are there is the sample? (R=0.0821 liter-atm/mole-K)

A. 0.0002 mole
B. 0.0378 mole
C. 0.0122 mole
D. 0.0091 mole

A certain gas at 101.325 Kpa and 10 degC whose volume is 2.83 m^3 are compressed into a storage vessel of 0.31m^3 capacity. Before admission, the storage vessel contained the gas at a pressure and temperature of 137.8 Kpa and 26 degC; after admission the pressure has increased to 1171.8 Kpa. What should be the final temperature of the gas in the vessel in kelvin?.

A. 298.0
B. 319.0
C. 180.0
D. 314.2

A perfect gas has a value of R= 58.8 ft-lb/lb-R and K= 1.26. if 20 Btu are added to 10 lbs of his gas at constant volume when initial temperature is 90 degF find the final temperature.

A. 97 degF
B. 104 degF
C. 154 degF
D. 185degF

Ammonia weighing 22 kgs is confirmed inside a cylinder equipped with a piston has an initial pressure of 413 Kpa at 35 degC if 3200 KJ of heat is added to the ammonia until its final pressure and temperature are 413 Kpa and 100 DegC respectively, what is the amount of work done by

A. 667
B. 304
C. 420
D. 502

A tank contains 90 ft^3 of air at a pressure of 350 Psig; of the air is cooled until its pressure and temperature decreases to 200 Psig and 70 DegF respectively, what is the decrease in internal energy?

A. 6232.09 Btu
B. -5552 Btu
C. 5552 Btu
D. -6232.09 Btu

A large mining company was provided with a 3 m^3 of compressed air tank. Air pressure in the tank drops from 700 kpa to 160 kpa while the temperature remains constants at 28 degC, what percentage has the mass of air in the tank been reduced?

A. 74.00
B. 72.45
C. 76.56
D. 78.57

A 4 m^3/hr pump delivers water to a pressure tank. At the start, the gage reads 138 Kpa until reads 276 KPa and then pump was shut off. The volume of the tank is 100 liters. At 276 Kpa the water occupied 2/3 of the tank volume. Determine the volume of water that can be taken out until the gage reads 138 Kpa.

A. 31.20 liters
B. 34.59 liters
C. 16.67 liters
D. 29.50 liters

A refrigeration plant is rated at 15 tons capacity. How many pounds of air per hour will it cool from 70 to 90 DegF at constant pressure.

A. 50,000 lb/hr
B. 37,500 lb/hr
C. 52,000 lb/hr
D. 45,000 lb/hr

an air standard engine has a compression ratio 18 and a cut-off ratio 4. If the intake air pressure and temperature are 100 kpa and 27deg C, find the work in KJ per kg.

A. 2976
B. 2166
C. 1582
D. 2751

determine the air standard efficiency of an operating on the diesel cycle with clearance of 6% , when the suction pressure is 99.97 kpa and the fuel is injected for 7% of the stroke. Assume k=1.4.

A. 62.11%
B. 51.20%
C. 73.58%
D. 60.02%

steam at 2Mpa and 250deg C in a rigid cylinder is cooled until the quality is 30%. Find the heat rejected from the cylinder.

A. -432.23
B. -926.26
C. -1265.02
D. 1082.34

At 1.8 Mpa, mixture steam and water has an entropy of 3 KJ/kg Deg K. find the enthalphy of the mixture.

A. 1,627.11KJ/kg
B. 1,533.33 KJ/kg
C. 1,234.45 KJ/kg
D. 1,162.40 KJ/kg

Mixture with 70% quality at 500kpa is heated isothermally until its pressure is 300kpa. Find the heat added during the process.

A. 745.92KJ/kg
B. 535.16 KJ/kg
C. 983.44 KJ/kg
D. 765.34 KJ/kg

A tank contains exactly one kilogram of water consisting of liquid and vapor in equilibrium at Mpa. If the liquid contains one-third and the remaining is vapor of the volume of the tank, what is the enthalpy of the contents of the tank?

A. 644.40 KJ/kg
B. 774.40 KJ/kg
C. 785.92 KJ/kg
D. 435.29 KJ/kg

Water substance at 70 bar and 65 degC enters a boiler tube of constant inside diameter of 25mm. the water leaves the boiler tube at 50 bar and 700degK at velocity of 150m/s/ calculate the inlet velocity(m/sec)

A. 1.56
B. 2.51
C. 1.672
D. 3.230

Water substance at 70 bar and 65 degC enters a boiler tube of constant inside diameter of 35mm. the water leaves the boiler tube at 50 bar and 700degK at velocity of 100m/s/ calculate the inlet volume flow (li/sec)

A. 0.821
B. 1.261
C. 0.344
D. 1.609

Steam leaves an industrial boiler at 827.4 Kpa and 171.6 deg. C. A portion of the steam is passed through a throttling calorimeter and is exhausted to the atmosphere when the calorimeter pressure is 101.4 Kpa. How much moisture does the steam leaving the boiler contain if the temperature of the steam at the calorimeter is 115.6 Deg. C.

A. 3.78%
B. 3.08%
C. 4.56%
D. 2.34%

A throttling is connected to the desuperheated steam line supplying steam to the auxiliary feed pump on a ship. The line pressure measrues 2.5 Mpa. The calorimeter pressure is 110 Kpa and 150 deg. C. determine the entropy of the steam line.

A. 6.8 KJ/Kg-K
B. 6.2 KJ/Kg-k
C. 6.6 KJ/Kg-k
D. 7.5 KJ/Kg-k

Atmospheric pressure at boils 212 deg. F. At the vacuum pressure at 24 in. Hg, the temperature is 142 deg F. Find the boiling temperature when the pressure is increased by 40 psia from atmospheric.

A. 449.42 F
B. 526.34 F
C. 479.13 F
D. 263.45 F

A certain coal has the following ultimate analysis:

C = 69%	N_2 = 5%
H_2 = 2.5%	S = 7%

Determine the amount of oxygen if the heating value of fuel is 26,961.45 KJ/Kg.

A. 1.5%
B. 2.5%
C. 3.5%
D. 4.5%

A diesel engine consumed 946 liters of fuel per day at 35 deg. C. if the fuel was purchased at 15.6 deg. C and 30 deg. API at P29.00/li, determine the cost of fuel to operate the engine per day.

A. P5677.50
B. P4677.50
C. P48,088.90
D. P27,127.76

A cylindrical tank 4m long and 3m diameter is used for oil storage. How many days can the tank supply the engine having 27 deg. API with fuel consumption of 60 kg/hr?

A. 17.53
B. 5.84
C. 12.84
D. 19.84

A logging firm in Isabella operates a Diesel Electric Plant to supply it's electric energy requirements. During a 24 hour period, the plant consumed 250 gallons of fuel at 80 deg. F and produced 2900 KW-hrs. Industrial fuel used is 30 deg. API and was purchased at P30.00/li at 60 deg. F. Determine the overall thermal efficiency of the plant.

A. 26.08%
B. 34.23%
C. 28.00%
D. 18.46%

The dry exhaust gas from oil engine has the following gravimetric analysis :

$CO_2 = 21.6\%$ $O_2 = 4.2\%$ $N_2 = 74.2\%$

Specific heats at constant pressure for each component of the exhaust gas in Kcal/kg-C are:

$CO_2 = 0.203$ $O_2 = 0.219$ $N_2 = 0.248$

Calculate the specific gravity if the molecular weight of air is 28.97 kg/lg-mol

A. 0.981

B. 1.244

C. 1.055

D. 0.542

A bituminous coal has the following composition:

C= 71.5% H = 5.0% O = 7.0% N = 1.3% S = 3% Ash = 7.6%

W = 3.4%

Determine the theoretical weight of Nitrogen in lb/lb of coal

A. 2.870
B. 7.526
C. 2.274
D. 6.233

A gaseous fuel mixture has a molal analysis:

H_2 = 14%	CH_4 = 3%	CO = 27%
O_2 = 0.6%	CO_2 = 4.5%	N_2 = 50.9%

Determine the air-fuel ratio for complete combustion on molal basis.

A. 2.130

B. 3.230

C. 1.233

D. 1.130

A volumetric analysis of a gas mixture is as follows:

CO_2 : 12%

O_2 : 4%

N_2 : 80%

CO_4 : 4%

What is the percentage of CO_2 on a mass basis?

A. 17.55%

B. 15.55%

C. 12.73%

D. 19.73%

The following coal has the following ultimate analysis by weight:

C = 70.5% H2 = 4.5% O2 = 6.0% N2 = 1.0%

S =3.0% Ash = 11% Moisture = 4%

A stocker fired boiler of 195,00 kg/hr steaming capacity used this coal as fuel. Calculate the volume of air in m^3/hr with air at 60 deg. F and 14.7 psia pressure if boiler efficiency is 70% and FE = 1.10

A. 234,019 m^3/hr
B. 215,830 m^3/hr
C. 213,830 m^3/hr
D. 264,830 m^3/hr

23.5 kg of steam per second at 5 Mpa and 400 deg. C is produced by a steam generator. The fedwater enters the economizer at 145 deg. C and leaves at 205 deg. C. the steam leaves the boiler drum with a quality of 98%. The unit consumes 3 kg of coal per second as received having a heating value of 25,102 KJ/kg. What would be the overall efficiency of the unit in percent?

Steam properties :

At 5 Mpa and 400 deg. C: h = 3195.7 KJ/kg

at 5 Mpa; hf = 1154.23, hfg = 1640.1

At 205 deg C: hf = 875.04 at 145 deg. C: hf = 1640.1

A. 65.72

B. 80.67

C. 88.28

D. 78.82

In an rankine cycle steam enters the turbine the turbine at 2.5 Mpa (enthalpies and entropies given) and condenser of 50 kPa (properties are given) what is the thermal efficiency of the cycle?.

A. 25.55%
B. 45.23%
C. 34.23%
D. 12.34%

A thermal power plant generates 5 MW and the heat generated by the fuel is 13,000 Kj/sec. if the thermal efficiency is 6.15% , find the power needed for the auxiliaries.

A. 310 Kw
B. 300 Kw
C. 400 Kw
D. 350 Kw

A superheat steam Rankine cycle has turbine inlet conditions of 17.5 MPa and 530 degC expands in a turbine to 0.007 Mpa. The Turbine and pump polytrophic efficiencies are 0.85 and 0.75 respectively, pressure losses between pump and turbine inlet are 1.5 Mpa. What should be the pump work in Kj/kg?

A. 17.34
B. 27.32
C. 25.32
D. 47.33

In an open feedwater heater for a steam plant, saturated steam at 7 bar is mixed sub-cooled liquid at 7 bar and 25 degC. Just enough steam is supplied to ensure that the mixed steam leaving the heater will be saturated liquid at 7 Bar when heater efficiency is 95%. Calculate the mass flow rate of sub-cooled liquid if steam flow rate is 0.865 kg/s.

A. 2.725 kg/s
B. 3.356 kg/s
C. 2.869 kg/s
D. 3.948 kg/s

A steam condenser receives 10 kg/s of steam with an enthalpy of 2770 kj/kg. steam condenses into a liquid and leaves with an enthalpy of 160 kj/kg. cooling water passes through the condenser with temperature increases from 13 DegC to 24 DegC. Calculate the water flow rate in Kg/s.

A. 583
B. 567
C. 523
D. 528

Steam expands adiabatically in a turbine from 200 Kpa, 400 DegC to 400 Kpa, 250 DegC. What is the effectiveness of the process in percent assuming an atmospheric pressure of 18 DegC. Neglect changes in kinetic and potential energy.

A. 82
B. 84
C. 79.60
D. 79.46

A heat exchanger was installed purposely to cool 0.50 kg of gas per second. Molecular weight is 32 and k = 32. The gas is cooled from 150 degC to 80 DegC. Water is available at the rate of 0.30 kg/s and at a temperature of 5 degC. Calculate the exit temperature of the water in degC.

A. 44.86
B. 42.88
C. 46.45
D. 40.34

A 350 mm x 450 mm steam engine running at 280 rpm has an entrance steam condition of 2 MPa and 230 degC and exit 0.1 Mpa. The steam consumption is 2000 kg/hr and mechanical efficiency is 85% if indicated mean effective pressure is 600 Kpa, determine brake thermal efficiency.

A. 23,34%
B. 15.25%
C. 14.16%
D. 27.34%

A steam turbine receives 5,000 kg/hr of steam at 5 Mpa and 400 DegC and velocity of 30 m/sec. It leaves the turbine at 0.006 Mpa and 85% quality and velocity of 15m/sec. radiation loss is 10,000 Kj/hr. find the KW developed.

A. 1273.29
B. 2173.29
C. 1373.60
D. 7231.29

A steam turbine with 85% stage efficiency receives steam at 7 Mpa and 550 degC and exhaust as 20 Kpa. Determine the turbine work.

A. 1,117 Kj/kg
B. 1,182 kj/kg
C. 1,123.34 kj/kg
D. 1,054.95 Kj/kg

A steam turbine with 80% stage efficiency receives steam at 7 Mpa and 550 DegC and exhaust as 20 Kpa, determine the quality at exhaust.

A. 96.96%
B. 76.34%
C. 82.34%
D. 91.69%

18,000 KW geothermal plant has a generator efficiency and turbine efficiency of 90% and 80%, respectively. The quality after throttling is 20% and each well discharges 400,000 kg/hr, determine the number of wells are required to produce if the change of enthalpy at entrance and exit of turbine is 500 kj/kg.

A. 4 wells
B. 2 wells
C. 6 wells
D. 8 wells

A liquid dominated geothermal plant with a single flash separator receives water at 204 DegC. The separator pressure is 1.04 Mpa. A direct contact condenser operates at 0.034 Mpa. The turbine has a Polytropic efficiency of 0.75 for a cycle output of 60 MW, what is the mass flow rate if the wall-water in kg/s?

A. 2,933
B. 2,100
C. 1,650
D. 2,444

An engine-generated rated 9000 KVA at 80% power factor, 3 phase, 4160 V has an efficiency of 90%. If overall plant efficiency is 28%, what is the heat generated by the fuel?

A. 18,800 KW
B. 28,800 KW
C. 7,500 KW
D. 25,714 KW

The indicated thermal efficiency of a two stroke diesel engine is 60%. If the friction power is 15% of the heat generated, determine the brake thermal efficiency of the engine.

A. 43%
B. 45%
C. 38%
D. 37%

A 305 mm x 457 mm four stroke single acting diesel engine is rated at 150 KW at 260 rpm. Fuel consumption at rated load is 0.56 Kg/Kw-hr with a heating value of 43,912 kj/kg. Calculate brake thermal efficiency.

A. 10.53%
B. 27.45%
C. 14.64%
D. 18.23%

A waste heat recovery boiler produces 4.8 Mpa (dry Saturated) steam from 104 deg C feed water. The boiler receives energy from 7 kg/sec of 954 deg C dry air. After passing through the waste heat boiler, the temperature of the air has been reduced to 343 degC. How much steam in kg is produced per second? Note at 4.60 Mpa dry saturated, h = 2796.

A. 1.30
B. 0.92
C. 1.81
D. 3.43

Diesel electric plant supplies energy for meralco, during a 24-hour period, the plant consumed 240 gallons of fuel at 28 degC and produced 3930 KW-hr. industrial fuel used is 28 deg API and was purchased at P30 per liter at 15,6 degC. What is the cost of fuel be to produced one KW-hr?

A. 6.87
B. 1.10
C. 41.07
D. 5.00

In a gas turbine unit, air enters the combustion chamber at 550 Kpa, 227 degC and 43 m/s. the products of combustion leave the combustor at 511 Kpa, 1004 degC and 180 m/s. liquid fuel enters with a heating value of 43,000 kj/kg. for Fuel-air ratio of 0.0029. what is the combustor efficiency of the unit in percent?

A. 70.38%

B. 79.30%

C. 75.38%

D. 82.38%

The specific speed of turbine is 85 rpm and running at 450 rpm. If the head is 20 m and generator efficiency is 90%. What is the maximum power delivered by the generator?

A. 450.51 KW
B. 354.52 KW
C. 650.53 KW
D. 835.57 KW

Francis Turbine, the Pressure gage leading to the turbine casing reads 380 Kpa. The velocity of water entering a turbine is 0 m/sec, if not hoad of the turbine is 45m. find the distance from center of spiral casing to the ….

A. 3.0 m
B. 3.5 m
C. 4.0 m
D. 4.5 m

A turbine has a mechanical efficiency of 93% volumetric efficiency of 95% and total efficiency of 82%. If the effective head is 40m, find the total head.

A. 48.72 m
B. 40.72 m
C. 36.22 m
D. 34.72 m

Pelton Type turbine has 25 m head friction loss of 4.5 m. the total coefficient of friction head loss (from morse) is 0.00093 and penstock length of 80 m, what is the penstock diameter?

A. 1,355.73 mm
B. 3,476.12 mm
C. 6,771.23 mm
D. 1686.73 mm

In an 9,000 KW hydro electric power plant the over-all efficiency is 88% and the actual power received by the customer is 110,000 Kw-hrs for that day. What is the secondary power could this plant deliver during the entire day?

A. 58,960 KW
B. 80,080 KW
C. 65,960 KW
D. 70,960 KW

Pelton type turbine was installed 30 m below the head gate of the penstock. The head loss due to friction is 12% of the given elevation. The length of penstock is 100 m and coefficient of friction is 0.00093 determine the power output in KW (use morse equation)

A. 22,273
B. 23,234
C. 32,345
D. 34,452

Water flows steadily with a velocity of 3.05 m/s in a horizontal pipe having a diameter of 25.24 cm. at one action of the pipe the temperature and pressure of the water are 21 degC and 689.3 Kpa, respectively. At a distance of 304.8 m downstream, the pressure is 516.9 Kpa. What is the friction factor?

A. 0.135
B. 0.0050
C. 0.0307
D. 0.641

A hydro electric plant having a 30 sq. km reservoir area and 100 m head is used to generate power. The energy utilized by the consumers whose load is connected to the power plant during a five-hour period is 13.5 x 10^6 Kwh. The overall generation efficiency is 75%. Find the fall in height of water in the reservoir after the 5-hour period.

A. 5.13 m
B. 1.32 m
C. 3.21 m
D. 2.20 m

The gas density of chimney is 0.75 kg/m^3 and air density of 1.15 kg/m^3. Find the driving pressure if the height of chimney is 63.71 m

A. 0.15 KPa
B. 0.25 Kpa
C. 0.35 Kpa
D. 0.45 Kpa

The actual velocity of gas entering in a chimney is 8 m/sec. the gas temperature is 25 degC with a gas constant of 0.267 kj/kg-K. determine the gas pressure for a mass of gas is 50,00 kg/hr and chimney diameter of 1.39 m

A. 95 Kpa
B. 98 Kpa
C. 101 kpa
D. 92 Kpa

A steam generator with economizer and air heater has an overall draft loss of 25.78 cm of water. If the stack gases are at 177 DegC and if the atmosphere is at 101.3 Kpa and 28 DegC. What theoretical height of stack in meters is needed when no draft fan are used? Assume that the gas constant for the flue gasses is the same as that for air.

A. 811.10
B. 631.10
C. 651.10
D. 671.10

A foundation measures 12 ft x 14 ft x 16 ft. find the number of sacks of cement needed for 1:2:4 mixture

A. 302
B. 404
C. 356
D. 598

A rectangular foundation cross-section has a bed plate dimension of 8 ft x 10 ft. the uniform clearance on each side is 1 ft. the height of foundation is 4.5 ft. if the weight of the steel bar reinforcements needed is ½% of weight of foundation, find the weight of steel bars, use concrete density of 2400 Kg/m^3.

A. 173.47
B. 183.47
C. 163.47
D. 153.47

A steam pipe having a surface temperature of 250 degC passes through a room where the temperature is 27 DegC the outside diameter of pipe is 100 mm and emissivity factor is 0.8 calculate the radiated headloss for 3m be length.

A. 1,434.47 W
B. 3,746.35 W
C. 2,851 W
D. 3,546.45 W

Brine enters a circulating brine cooler at the rate of 80 m%3/hr at -8 degC, specific heat of brine is 1.072 kj/kg-K and specific gravity of 1.12. determine the tons of refrigeration.

A. 53.5 TR
B. 65.3 TR
C. 33.5 TR
D. 56.9 TR

A turbo-charged, 16 cylinder, Vee-type diesel engine has an air consumption of 3,000 kg/hr per cylinder at rated load and speed, this air is drawn in through a filter by a centrifugal compressor directly connected to the exhaust gas turbine. The temperature of the air from the compressor is 135 DegC and a counter flow air cooler reduces the air temperature to 45 degC before it goes to the engine suction header. Cooling water enters air cooler 30 degC and leaves at 40 degC. Calculate the log mean temperature difference.

A. 47.23 DegC
B. 87.82 degC
C. 43.34 degC
D. 65.42 degC

Water is flowing in a pipe with radius of 30 cm at a velocity of 5 m/sec at the temperature in the pipe. The density and viscosity of the water are as follows density = 997.9 kg/sec viscosity = 1.131 Pa. what is the Reynolds number of this situation?

A. 2647
B. 96.2
C. 3100
D. 140

Compute the amount of condensate form during 10 minutes warm-up of 180 meter pipe conveyors the saturated steam with enthalpy vaporization hfg = 1,947.6 kj/kg. the minimum external temperature of pipe is 2 DegC. The final temperature of pipe is 195 degC. The specific heat of pipe material is 0.6 kj/kg-C. the specific weight if 28 g/m.

A. 249.69 kg
B. 982.45 kg
C. 299.64 kg
D. 423.45 kg

The discharge pressure of an air compressor is 5 times the suction pressure. If volume flow at suction is 0.1 m^3/sec. what is the suction pressure if compressor work is 19.57 kw? (use n = 1.35)

A. 97 Kpa
B. 98 Kpa
C. 99 Kpa
D. 100 Kpa

The initial condition of air in an air compressor is 93 Kpa and 27 deg. C and discharges air at 450 Kpa. The bore and stroke are 355 mm and 381 mm, respectively with percent clearance of 8% running at 300 rpm. Find he volume of air at suction.

A. 541.62 m^3/hr
B. 551.62 m^3/hr
C. 561.62 m^3/hr
D. 571.62m^3/hr

An air compressor has a suction volume of 0.35 m^3/sec at 97 Kpa and discharges to 650 Kpa. How much power is saved by the compressor if there are two stages?

A. 27 KW
B. 16.54 KW
C. 13.86 KW
D. 11.58 KW

A two stage air compressor has an intercooler pressure of 4 kg/cm^2. What is the discharge pressure if suction pressure is 1 kg/cm^2?

A. 3 kg/cm^2
B. 9 kg/cm^2
C. 12 kg/cm^2
D. 16 kg/cm^2

A two-stage air compressor air at 100 Kpa and 22 deg. C discharges to 750 Kpa. If the intercooler intake is 105 deg. C, Determine the value of n.

A. 1.400
B. 1.326
C. 1.345
D. 1.288

A single acting air compressor has a volumetric efficiency of 89%, operates at 500 rpm. It takes in air at 100 Kpa and 30 deg. C and discharges it at 600 Kpa. The air handled is 8 m^3/min measured at discharge condition. If compression is isentropic, find mean effective pressure in Kpa.

A. 233.34
B. 973.17
C. 198.34
D. 204.82

Water-jacketed air compressor handles .0343 m^3/s of air entering at 96.5Kpa and 21 deg. C and leaving at 480 Kpa and 132 deg. C; 10.9 kg/h of cooling water enters the jacket at 15 deg. C and leaves at 21 deg. C, Determine the compressor brake power?

A. 26.163 kw
B. 62.650 kw
C. 84.44 kw
D. 19.33 kw

A double suction centrifugal pumps delivers 20 ft^3/sec of water at head of 12 m and running at 650 rpm. What is the specific speed of the pump?

A. 5014.12 rpm
B. 6453.12 rpm
C. 2770.73 rpm
D. 9968.73 rpm

Determine the number of stages needed for a centrifugal pump if it used to deliver 400 gal/min of water and pump power of 15 Hp. Each impeller develops a head of 30 ft.

A. 8
B. 4
C. 5
D. 7

The suction pressure of a pump reads 3 in. of mercury vacuum and discharge pressure reads 140 psi is use to deliver 120 gpm of water with specific volume of 0.0163 ft^3/lb. Determine the pump work.

A. 4.6 KW
B. 5.7 KW
C. 7.4 KW
D. 8.4 KW

A submersible pump delivers 350 gpm of water to a height of 5 ft from the ground. The pump were installed 150 m below the ground level and a drawdown of 8 ft during the operation, if the water level is 25 ft above the pump, determine the pump power.

A. 7.13 KW
B. 4.86 KW
C. 7.24 KW
D. 9.27 KW

A vacuum pump is used to drain a flooded mine shaft of 20 deg. C waer. The pump pressure of water at this temperature is 2.34 Kpa. The pump is incapable of lifting the water higher than 16 m. what is the atmospheric pressure.

A. 159.30
B. 132.33
C. 198.22
D. 171.9

A submersible, multi-stage, centrifugal deep well pump 260 gpm capacity is installed in a well 27 feet below the static water level and running at 3000 rpm. Drawdown when pumping at rated capacity is 10 feet. The pump delivers the water into a 25,000 gallons capacity overhead storage tank. Total discharge head developed by pump, including friction in piping is 243 feet. Calculate the diameter of the impeller of this pump in inches if each impeller diameter developed a head of 38 ft.

A. 3.28
B. 5.33
C. 3.71
D. 6.34

A fan draws 1.42 m^3 per second of air at a static pressure of 2.54 cm of water through a duct 300 mm diameter and discharges it through a duct of 275 mm diameter. Determine the static fan efficiency if total fan mechanical is 75% and air is measured at 25 deg. C and 760 mm Hg.

A. 50.11%
B. 53.69%
C. 65.67%
D. 45.34%

A water coolers uses 50lb/hr of melting ice to cool running water from 80deg F to 42deg F. based on the inside coil area U=110 btu/hr-ft^2-F. Find the gpm of water cooled.

A. 0.10 GPM
B. 0.21 GPM
C. 0.38 GPM
D. 0.45 GPM

The charge in a diesel engine consist of 18.34 grams of fuel, with lower heating value of 42,571 KJ/KG, and 409 grams of fuel and products of combustion. At the beginning of compression, t1-60degC, let Rk=14. For constant Cp=1.11 KJ/KG-C, what should be the cut-off ratio in the corresponding ideal cycle ?

A. 2.05
B. 2.34
C. 5.34
D. 2.97

The gain of entropy during nonflow process of 5lb of air at 60degF is 0.162 Btu/R. find the V1/V2

A. 3.35
B. 0.259
C. 1.0
D. 0.296

An auditorium seating 1500 people is to be maintained at 80degF dry bulb and 65degF wet bulb temp. when outdoor air is at 91degfF dry bulb and 75degF wet bulb. Solar heat loads is 110,000 btu/hr and supply air is at 60degF, determine the amount of air supply.

A. 93,299.17 lb/hr
B. 83,299.17 lb/hr
C. 73,299.17 lb/hr
D. 63,299.17 lb/hr

In a brayton cycles that operates between temperature limits of 300K and 1773K with K=1.4, determine the temperature at the end of the compression (isentropic) for maximum work of the cycle.

A. 700K
B. 690.5K
C. 730K
D. 350K

At 35% solution leaves the absorber and 30% solution enters the absorber. The heat removed from the absorber by cooling water is 547.6 Btu and ammonia is superheated by 10deg. Find the pound per pound of ammonia gas from the evaporating coils.

A. 11
B. 12
C. 13
D. 14

A carnot refrigeration system operates at Tmax./Tmin.=1.5, Find the KW per to of refrigeration.

A. 1.91
B. 2.15
C. 1.76
D. 1.55

Assume 8ft^3 of air at 100psi, 100degF are compressed isothermally to a volume of 2ft^3. For each of end state the process, find the bulk modulus.

A. 400 and 100 psi
B. 400 and 110 psi
C. 400 and 120 psi
D. 400 and 130 psi

Predict the pressure of nitrogen gas at T=200K and v=0.00385 m^3/kg and b=0.00141 m^3/kg; a=0.178 m^2 kpa/kg^2. Use van der waals equation,

A. 15,331 kpa
B. 14,331 kpa
C. 13,331 kpa
D. 12,331 kpa

Francis turbine is to be operated at a speed of 600rpm and with discharge of 4m^3/s. if r1=0.6m, beta1=110deg, and the blade height B is 10cm, what should be the guide angle a1 for non separating flow condition at the runner entrance ?

A. 14.4 deg
B. 15.4 deg
C. 16.4 deg
D. 17.4 deg

The total head of fan is 187m and has a static pressure of 210mm of water gage, what is the velocity of air flowing if density of air is 1.15 kg/m^3 ?

A. 6.85 m/sec
B. 3.45 m/sec
C. 4.39 m/sec
D. 9.28 m/sec

A fan delivers 5.7 m^3/sec. at a static pressure of 5.08 cm of water when oerating at a speed of 400rpm. The power input required is 2.963 KW. If 7.05 m^3/sec. are desired in the same fan and installation, find the pressure in cm of water.

A. 7.77
B. 17.14
C. 11.43
D. 5.08

A rigid container is closed at one end and measures 8 in diameter by 12 in long. The container is held vertices and slowly moved downward until the pressure in the container is 17psia. What will be the depth of the top of the container from the free water surface ?

A. 42.36in
B. 59.29in
C. 63.69in
D. 69.82in

An empty, open can is 30 cm high, with a 15 cm diameter. The can with the open end down is pushed under water with a density of 1000 kg/m^3. Find the water level in the can when the top of the can is 50 cm below the surface.

A. 17.20 cm
B. 2.12 cm
C. 4.20 cm
D. 5.87 cm

A cylindrical pipe with water flowing downward at 0.03 m^3/s having top diameter of 0.08, bottom diameter of 0.04 m and height of 1.5 m. find the pressure between the pipe.

A. 154.63 Kpa
B. 197.93 Kpa
C. 252.44 Kpa
D. 243.92 Kpa

Determine the size of pipe which will deliver 8 liter of medium oil (c = 6.10 x 10 ^-6 m^2/s) assuming laminar flow conditions

A. 622 mm
B. 754 mm
C. 950 mm
D. 835 mm

The type of flow occupying in a 1 cm diameter pipe which water flows at a velocity of 2.50m/s. Use v = 1.13 x 10^-6 m^2/s for water.

A. Turbulent
B. Constant
C. Laminar
D. None of these

What force is exerted by water jet 60 mm diameter if it strikes a wall at he rate of 15 m/s?

A. 636.17 N
B. 442.62 N
C. 764.23 N
D. 563.34 N

A 300 mm diameter pipe discharges water at the rate of 200 li/s. point 1 on the pipe has a pressure of 260 Kpa and 3.4 m below point 1 is point 2 with a pressure of 300 Kpa. Compute the head loss between points 1 and 2.

A. 4.29 m
B. 2.59 m
C. 6.32 m
D. 1.87 m

Water flowing at the rate of 10 m/s from an orifice at the bottom of a reservoir. Find the pressure at the bottom of reservoir.

A. 30 Kpag
B. 40 Kpag
C. 50 Kpag
D. 60 Kpag

Steam flows through a nozzle at 400 deg. C and 1 Mpa (h = 3263.9 KJ/kg) with velocity of 300 m/s. find the stagnation enthalpy.

A. 3300 KJ/kg
B. 3290 KJ/kg
C. 3320 KJ/kg
D. 3309 KJ/kg

Air flows through a nozzle at a speed of 350 m/s. Find the stagnation temperature if entrance temperature is 200 deg. C

A. 241.25 deg. C
B. 251.25 deg. C
C. 261.25 deg C
D. 271.25 deg. C

Carbon dioxide flows through a nozzle with a speed of 400 m/s. Compute the dynamic temperature.

A. 92.56 K
B. 94.56 K
C. 96.56 K
D. 98.56 K

Carbon dioxide flows through a nozzle with a speed of 380 m/s. The entrance condition of nozzle is 250 deg. C and 1200 Kpa. Find the stagnation pressure.

A. 2,136.34 Kpa
B. 2,146.34 Kpa
C. 2,156.34 Kpa
D. 2,166.34 Kpa

Air enters a diffuser with a velocity of 200 m/s. determine the velocity of sound if air temperature is 30 deg. C

A. 349 m/s
B. 359 m/s
C. 369 m/s
D. 379 m/s

Air flows through a nozzle with temperature of entrance of 420 deg. K stagnation temperature of 468 deg. K. find the mach number.

A. 0.744
B. 0.754
C. 0.764
D. 0.774

Air at 300 deg. K and 200 Kpa is heated at constant pressure to 600 deg. K. determine the change of internal energy.

A. 245.58 KJ/kg
B. 235.58 KJ/kg
C. 225.58 KJ/kg
D. 215.58 KJ/kg

An insulated rigid tank initially contains 1.5 lb of helium at 60 deg F and 50 psia. A paddle wheel with power rating of 0.02 hp is operated within the tank for 30 min. Determine the final temperature.

A. 159.22 deg. F
B. 169.22 deg. F
C. 179.22 deg. F
D. 189.22 deg. F

A 4 m^2 asphalt pavement with emissivity of m0.85 has a surface temperature of 50 deg. C. Find the maximum rate of radiation that can be emitted from the surface.

A. 2,068.32 watts
B. 2,078.32 watts
C. 2,088.32 watts
D. 2,098.32 watts

Air at 10 deg. C and 80 Kpa enters a diffuser of a jet engine steadily with a velocity of 200 m/s. The inlet area of diffuser is 0.40 m^2. Determine the mass flow rate of air.

A. 72.79 kg/s
B. 74.79 kg/s
C. 76.79 kg/s
D. 78.79 kg/s

Consider a refrigeration whose 40 watts light bulb remains on continuously as a result of malfunction of the switch. If the refrigerator has a COP of 1.3 and the cost of electricity is 8 cents per kw-hr, determine the increase in the energy consumption of the refrigerator and its cost per year if the switch is not fixed.

A. P49.59
B. P47.59
C. P 45.59
D. P43.59

A 75hp motor that has an efficiency of 91% is worn out and is replaced by high-efficiency motor that has an efficiency of 95.4%. Determine the reduction in heat gain in room due to higher efficiency under full load conditions.

A. 2.24 KW
B. 2.44 KW
C. 2.64 KW
D. 2.84 KW

A household refrigerator that has a power input of 450 watts and COP of 2.5 is to cool five large watermelons, 10 kg each, if the watermelons are initially at 20 deg. C, determine how long will take for the refrigerator to cool them. the watermelons can be treated as water whose specific heat is 4.2 KJ/kg-K.

A. 2220 seconds
B. 2230 seconds
C. 2240 seconds
D. 2250 seconds

When a maN returns to his wall-sealed house on a summer day, he finds that the house is at 32 deg. C. he turned on the air conditioner which cools the entire house to 20 deg. C in 15 minutes. If COP is 2.5, determine the power drawn by the air-conditioner. Assume the entire mass within the house is 800 kg of air for which Cv = 0.72 KJ/kg-K, Cp = 1.0 KJ/kg-K.

A. 1.072 KW
B. 2.072 KW
C. 3.072 KW
D. 4.702 KW

A heat source at 800 K losses 2000 KJ of heat to a sink at 500 K. Determine the entropy generated during this process.

A. 1.5 KJ./k
B. 2.5 KJ/k
C. -2.5 KJ/k
D. 4 KJ/k

A helium gas is compressed on in an adiabatic compressor from an initial state of 14 psia and 50 deg. F to a final temperature of 320 deg F in a reversible manner. Determine the exit pressure of helium.

A. 38.5 psia
B. 40.5 psia
C. 42.5 psia
D. 44.5 psia

Air pass thru a nozzle with efficiency of 90%. The velocity of air at the exit is 600 m/s. find the actual velocity at the exit.

A. 382 m/s
B. 540 m/s
C. 458 m/s
D. 568 m/s

A 50 kg of iron casting at 500 K is thrown into a large lake that is at temperature of 285 K. the iron block eventually reaches thermal equilibrium with the lake water. Assuming average specific heat of 0.45 KJ/kg-K for the iron, determine the entropy generated during this process.

A. -12.65 KJ/K
B. 16.97 KJ/K
C. 4.32 KJ/K
D. 6.32 KJ/K

A windmill with a 12 m diameter rotor is to be installed at location where the wind is blowing at an average velocity of 10 m/s. Using standard condition of air (1 atm, 25 deg. C), determine the maximum power that can be generated by the windmill.

A. 68 KW
B. 70 KW
C. 72 KW
D. 74 KW

Consider a large furnace that can supply heat at temperature of 2000 deg. R at a steady rate of 3000 Btu/s. Determine the exergy of this energy. Assume an environment temperature of 77 deg. F.

A. 205.19 KW
B. 2315.19 KW
C. 2325.19 KW
D. 2335.19 KW

A heat engine receives heat from a source at 1200 deg. K at rate of 500 KJ/s and rejects the waste heat to a medium at 300 deg. K. the power output of the heat engine is 180 KW. Determine the irreversibility rate for this process.

A. 190 KW
B. 195 KW
C. 200 KW
D. 205 KW

A dealer advertise that he has just received a shipment of electric resistance heaters for residential buildings that have an efficiency of 100 percent. Assuming an indoor temperature of 21 deg. C and outdoor temperature of 10 deg. C, Determine the second law efficiency of these heaters.

A. 8.74 %
B. 6.75 %
C. 3.74 %
D. 4.74 %

A thermal power plant has a heat rate of 11,363 Btu/hr. find the thermal efficiency of the plant.

A. 34 %
B. 24 %
C. 26 %
D. 30 %

A rigid tank contains 2 kmol of N2 and 6 kmol of CO2 gases at 300 deg. K and 115 Mpa. Find the tank volume using ideal gas equation.

A. 7.33 m^3
B. 5.33 m^3
C. 3.33 m^3
D. 1.33 m^3

A spherical balloon with a diameter of 6 m is filled with helium at 20 deg. C and 200 Kpa. Determine the mole number.

A. 9.28 Kmol
B. 10.28 Kmol
C. 11.28 Kmol
D. 13.28 Kmol

The air in an automobile tire with a volume of 0.53 ft^3 is at 90 deg. F and 20 psig. Determine the amount of air that must be added to raise the pressure to the recommended value of 30 psig. Assume the atmospheric pressure to be 14.6 psia and the temperature and the volume to remain constant.

A. 0.026 lb
B. 0.046 lb
C. 0.066 lb
D. 0.086 lb

A rigid tank contains 20 lbm of air at 20 psia and 70 deg. F. more air is adde to the tank until the pressure and temperature rise to 35 psia and 90 deg. F, respectively. Determine the amount of air added to the tank.

A. 11.73 lb
B. 13.73 lb
C. 15.73 lb
D. 17.73 lb

A rigid tank contains 5 kg of an ideal gas at 4 atm and 40 deg. C. Now a valve is opened, and half of mass of the gas is allowed to escape. If the final pressure in the tank is 1.5 atm. The final temperature in the tanks is:

A. -38 deg. C
B. -30 deg. C
C. 40 deg. C
D. 53 deg. C

The pressure of an automobile tire is measured to be 200 Kpa (gage) before the trip and 220 kpa (gage) after the trip at a location where the atmospheric pressure is 90 kpa. If the temperature of the air in the tire before the trip is 25 deg. C, the air temperature after the trip is:

A. 45.6 deg. C
B. 54.8 deg C.
C. 27.5 deg. C
D. 26.7 deg. C

Water boils at 1 atm pressure in a stainless steel pan on an electric range. It is observed that 2 kg of liquid water evaporates in 30 min. the rate of heat transfer to the water is>

A. 2.97 KW
B. 0.47 KW
C. 2.51 KW
D. 3.12 KW

Consider a person standing on a breezy room at 20 deg. C. Determine the total rate of heat transfer from this person if the exposed surface area and the average outer surface temperature of the person are 1.6 m^2 and 29 deg. C respectively, and the convection heat transfer coefficient is 6 W/m^2 with the emissivity factor of 0.95.

A. 86.40 watts
B. 81.70 watts
C. 198.1 watts
D. 168.1 watts

Water is boiling in a pan on a stove at sea level. During 10 minutes of boiling, it is observed that 200 grams of water has evaporated. Then the rate of heat transfer to the water is:

A. 0.84 KJ/min
B. 45.1 KJ/min
C. 41.8 KJ/min
D. 53.5 KJ/min

An aluminum pan whose thermal conductivity is 237 W/m-C has a flat bottom whose diameter is 20 cm and thickness 0.4 cm. heat is transferred steadily to boiling water in the pan through its bottom at a rate of 500 watts. If the inner surface of the bottom of the pan is 105 deg. C, determine the temperature of the surface of the bottom of the pan

A. 95.37 deg. C
B. 105.27 deg. C
C. 115. 27 deg. C
D. 125.27 deg. C

For a heat transfer purposes, a standing man can be modeled as a 30 cm diameter, 170 cm long vertical cylinder with both the top and bottom surfaces insulated and with the side surface at an average temperature of 34 deg. C. for convection heat transfer coefficient of 15 W/m^2-C, determine the rate of heat loss from this man by convection in an environment at 20 deg. C.

A. 316.46 watts

B. 326.46 watts

C. 336.46 watts

D. 346.46 watts

A 5 cm diameter spherical ball whose surface is maintained at a temperature of 70 deg. C is suspended in the middle of a room at 20 deg. C. if the convection heat transfer coefficient is 15 W/m^2-C and the emissitivity of the surface is 0.8, determine the total heat transfer from the ball.

A. 23.56 watts
B. 32.77 watts
C. 9.22 watts
D. 43.45 watts

A frictionless piston-cylinder device and a rigid tank contain 1.2 kmol of ideal gas at the same temperature, pressure and volume. Now heat is transferred, and the temperature of both system is raised by 15 deg. C. the amount of extra heat that must be supplied to the gas in the cylinder that is maintained at constant pressure.

A. 0
B. 50 KJ
C. 100 KJ
D. 150 KJ

A supply of 50 kg of chicken at 6 degC contained in a box is to be frozen to -16 degC in a freezer. Determine the amount of heat that needs to be removed. The latent heat of the chicken is 247 kj/kg and its specific heat is 32 kj/kg-C above freezing and 1.77 Kj/kg-C below freezing. The container box is 5 kg and the specific heat of the box material is 1.4 kj/kg-C. also the freezing temperature of chicken is -2.8 C.

A. 15,206.4 KJ
B. 50.5 KJ
C. 15,156 KJ
D. 1,863 KJ

Water is being heated in a closed pan on top of a range while being stirred by a paddle wheel. During process, 30 kJ of heat is transferred to the water, and 5 KJ is lost to the surrounding air. The paddle wheel work amounts to 500 N-m. Determine the final energy of the system if its initial energy is 10 KJ

A. 35.5 KJ
B. 45.5 KJ
C. 25.5 KJ
D. 14.5 KJ

A classroom that normally contain 40 people is to be air-conditioned with window air-conditioning units of 5 KW cooling capacity. A person at rest may be assumed to dissipate heat at a rate of about 360 Kj/hr. there are 10 light bulbs in the room, each with a rating of 100 watts. The rate of heat transfer to the classroom through the walls and the windows is estimated to be 15,000 Kj/hr. if the room air is to be maintained at a constant temperature of 21 degC, determine the number of window air-conditioning units required.

A. 1 unit
B. 2 units
C. 3 units
D. 4 units

4m X 5m x 6m room is to be heated by a baseboard resistance heater. It is desired that the resistance heater able to raise the air temperature in the room from 7 to 23 degC within 15 minutes. Assuming no heat losses from the room and an atmospheric pressure of 100 Kpa, determine the required power of the resistance heater. Assume constant specific heats at room temperature.

A. 2.34 KW
B. 1.91 KW
C. 4.56 KW
D. 6.34 KW

A student living in a 4m x 6m x 6m dormitory room turns on her 150 watts fan before she leaves the room on a summer day, hoping that the room will be cooled when she comes back in the evening, assuring all the doors and window are lightly closed and disregarding any heat transfer through the walls and the windows, determine a temperature in the room when she comes back 10 hours later. Use specific heat values at room temperature, and assume the room to be at 100 kpa and 15 degC in the morning when she leaves.

A. 28.13 degC
B. 38.13 degC
C. 48.13 degC
D. 58.13 degC

A piston-cylinder device whose piston is resting on top of a set of stops initially contains 0.50 kg of helium of gas at 100 Kpa and 25 degC. The mass of the piston is such that 500 KPa of pressure is required to raise it. How much heat must be transferred to the helium before the piston starts rising?

A. 1557.13 KJ
B. 1657.13 KJ
C. 1757.13 KJ
D. 1857.13 KJ

In order to cool 1 ton (1000 kg) of water at 20 degC in an insulated tank, a person pours 80 kg of ice at -5 degC into the water. Determine the final equilibrium temperature in the tank. The melting temperature and the heat of fusion of ice at atmospheric pressure are 0 degC and 333.7 KJ/kg, respectively.

A. 12.43 degC
B. 14.43 degC
C. 16.43 degC
D. 18.43 degC

A fan is powered by a 0.5 Hp motor and delivers air at a rate of 85 m^3/min. determine the highest value for the average velocity of air mobilized by the fan. Take the density of air to be 1.18 kg/m^3

A. 18.23 m/s
B. 21.12 m/s
C. 25.34 m/s
D. 32.23 m/s

An ocean-thermal energy conversion power plant generates 10,000 KW using a water surface water inlet temperature of 28 degC and a cold deep-water temperature of 15 degC, on the basis of a 3 DegC drop in the temperature of the warm water and a 3 DegC rise in the temperature of the cold water due to removal and addition of heat. Calculate the power required in KW to pump the cold0deeo water to the surface and through the system heat exchanger if the required pumping pressure increase is 20 KPa. Assume a carnot cycle efficiency and density of cold water to be 1000 kg/m^3.

A. 108
B. 250
C. 146
D. 180

A plate type solar energy collector with absorbing surface covered by a glass plate is to receive an inci… Radiation of 800 W/m^2. The glass plate has a reflectivity of 0.12 and a transitivity of 0.85. the absorbing surface has an absorptivity of 0.90. the area of the collector is 5 m^2. How much solar energy in watts is absorbed by the collector?

A. 2500
B. 2880
C. 3510
D. 3060

A tank contains liquid nitrogen at -120 degC is suspended in a vacuum shell by three stainless steel rods 0.80 meter and 3 meters long with a thermal conductivity of 16.3 W/m^2-C. if the ambient air outside the vacuum shell is 15 degC. Calculate the magnitude of the conductive heat flow in watts along the supports rods.

A. 0.168
B. 0.0587
C. 0.182
D. 0.176

An elastic sphere containing gas at 120 Kpa has a diameter of 1.0 m. heating the sphere causes it to expand its diameter of 1.3m, during the process the pressure is proportional to the sphere diameter. Calculate the work done by the gas in KJ.

A. 41.8
B. 50.6
C. 87.5
D. 35.4

An ideal gas with a molecular weight of 7.1 kg/kg is compressed from 600 Kpa and 280 degK to a final specific volume of 0.5 m^3/kg. during the process the pressure varies according to p= 620 + 150v + 95 v^2 where p is in KPa and V in m^3/kg. calculate the work of compression in KJ/kg?

A. 32.6
B. 28.7
C. 35.6
D. 33.33

A one cubic meter container contains a mixture of gases composed of 0.02 kg/mol of oxygen and 0.04 kg-mol helium at a pressure of 220 Kpa. What is the temperature of this ideal gas mixture in degrees kelvin?

A. 441
B. 350
C. 400
D. 450

Methyl alcohol (CH3OH) is burned with 25% excess air. How much unburned oxygen in kg-mol-oxygen/kg-mol-fuel will there be in the products if the product of combustion is compete?

A. 0.35
B. 0.45
C. 0.37
D. 0.65

A 12 DC electrical motor draws a current of 15 amps. How much work in KJ does this motor produce over a 10 minute period of operation?

A. 108.0
B. 129.6
C. 216.0
D. 318.2

A 4 liter (2 liter per revolution at standard pressure temperature) spark engine has a compression ratio of 8 and 2200 KJ/kg Heat addition by the fluid combustion. Considering a cold air-standard Otto Cycle model, how much power will the engine produce when operating at 2500 rpm?

A. 166.53 HP
B. 73.12 HP
C. 97.4 HP
D. 148 HP

A simple Rankine produces 50 MW of power, 40 MW of process heated and rejects 50 MW of heat to the surroundings. What is the utilization factor of this cogeneration cycle neglecting the pump work?

A. 50%
B. 60%
C. 64%
D. 80%

The rate of heat transfer to the surroundings from a person at rest is about 400 Kj/Hr. suppose that the ventilation system falls in an auditorium containing 120 people and assuming that the energy goes into the air of volume 1500 m^3 initially at 300 degK and 101 Kpa , calculate the rate in degC/min of air temperature change.

A. 0.81
B. 0.53
C. 0.63
D. 1.0

An insulated box containing helium gas falls from a balloon 4.5 Km above the __________. Calculate the temperature rise in degC of the helium when the box hits the ground.

A. 15.2
B. 12.6
C. 25.3
D. 14.1

Consider two Carnot heat engines operating in series. The first engine receives heat from the reservoir at 2400 degK and rejects the waste heat to another reservoir at temperature T. the second engine receives heat from the first one, convert sine if it to work, and rejects the rest to a reservoir at 300 degK. If thermal efficiencies of both engines are the same, determine the temperature T.

A. 849 degK
B. 578 degK
C. 763 degK
D. 978 degK

An ideal gas mixture consist of 2 Kmol of N_2 and 6 Kmol of CO_2. The mass fraction of CO_2 is:

A. 0.175
B. 0.250
C. 0.825
D. 0.750

A carnot cycle is operates between the temperature limits of 300 degK and 1500 degK and produces 500 KW of net power. The value of entropy change of the working fluid during the heat addition process is,

A. 0
B. 0.4 KW/K
C. 0.5 KW/k
D. 2.0 KW/K

Air in an ideal diesel cycle is compressed from 3 L to 0.15 L and then it expands during the constant pressure heat addition process to 0.3 L, under cold air standard conditions, the thermal efficiency of the cycle is

A. 35 percent
B. 44 percent
C. 65 percent
D. 70 percent

Air enters a turbojet engine at 200 m/s at a rate of 20 kg/s and exist at 800 m/s relative to the aircraft. The thrust developed by the engine is:

A. 6 KN
B. 12 KN
C. 16 KN
D. 20 KN

Heat engine receives heat from a source at 1200 DegK at a rate of 500 Kj/s and rejects the waste heat to a sink 300 degK. If the power output of the engine is 200 KW, the second law efficiency of this heat engine is

A. 35%
B. 40%
C. 53%
D. 75%

A water reservoir contains 100,000 kg of water at an average elevation of 60m. the maximum amount of electric power that can be generated from this water is:

A. 8 KWh
B. 16 KWh
C. 1630 KWh
D. 65,800 KWh

A house s maintained at 22 degC in winter by electric resistance heater. If the outdoor temperature is 5 degC, the second law efficiency of the resistance heater is:

A. 0 %
B. 5.8 %
C. 34 %
D. 77 %

Thermoelectric refrigerator that resembles a small ice chest is powered by a car battery, and has a COP of 0.10. If the refrigerator cools a 0.350 L canned drink from 20 degC to 4 degC in 30 mins, determine the average electric power consumed bu the thermoelectric refrigerator.

A. 130 watts
B. 110 watts
C. 120 watts
D. 140 watts

Carnot refrigerator operates in a room in which the temperature is 25 degC and consumes 2KW of power when operating. If the food compartment of the refrigerator is to be maintained at 3 degC, determine the rate of heat removal from the food compartment.

A. 1504.8 KJ/min
B. 12.86 Kj/min
C. 1625 KJ/min
D. 9.57 KJ/min

A household refrigerator with EER 8.0 removes heat from the refrigerated space at a rate of 90 KJ/min. determine, the rate of heat transfer to the kitchen air

A. 101.25 KJ/min
B. 63.05 Kj/min
C. 128.46 Kj/min
D. 80 Kj/min

An air conditioning system is used to maintain a house at 75 degF when the temperature outside is 95 degF. The house is gaining heat through the walls and windows at a rate of 1250 BTU/min, and the heat generation rate within the house from people, lights, and appliances amounts to 350 Btu/min. determine the minimum power input required for this air-conditioning system.

A. 10.06 HP

B. 1.36 HP

C. 1.41 HP

D. 7.94 HP

A refrigeration system is to cool bread loaves with an average mass of 450 g from 22 degC to -10 degC at a rate of 500 loaves per hour by refrigerated air. Taking the average specific and latent heats of the bread to be 2.93 Kj/kg – C and 109.3 KJ/Kg , respectively, determine the product load.

A. 541.7 Kj/min
B. 351.6 Kj/min
C. 761.5 KJ/min
D. 409.9 Kj/min

A house that was heated by electric resistance heaters consumed 1200 KWh electric energy in a winter month. If this house were heated instead by a heat pump that has an average performance factor PF of 2.4, determine how much money the homeowner would be saved that month assume a price of 0.0855 $/KWh for electricity.

A. $42.5
B. $59.5
C. $102
D. $97.75

An ammonia simple saturation cycle operates with a suction pressure of 291.6 Kpa and a condenser pressure of 1204 Kpa develops 15 Tons of refrigeration. Determine the theoretical horsepower of the compressor.

A. 7.23 HP
B. 13 HP
C. 15 Hp
D. 8.23 HP

An ammonia ice plant operates between a condenser temperature of 35 degC and evaporator of -15 degC. It produces 10 metric tons of ice per day from water at 30 degC to ice at -5 degC. Assuming simple saturation cycle, determine the horsepower of the motor if the adiabatic efficiency of the compressor is 0.85 and mechanical efficiency is 0.95. the specific heat of ice is 2.094 Kj/Kg-C and the latent heat is 335 Kj/kg.

A. 17.68 Hp

B. 18.61 Hp

C. 15.5 Hp

D. 21.9 HP

Freon 22 air conditioning under standard operating conditions of 35 degC condensing and 5 degC evaporating temperatures, the volume flow rate entering the compressor is 23.72 L/s. determine the refrigerating capacity if the refrigerating effect is 164 Kj/Kg.

A. 339.3 TR
B. 79.3 TR
C. 96.4 TR
D. 27.4 TR

The refrigerant volume flow rate at the entrance of compressor were obtained from a test on a twin cylinder, single acting 15 cm x 20 cm, 320 rpm compressor ammonia refrigerating plant to be 33 L/s. determine the volumetric efficiency of the compressor.

A. 77.65 %
B. 87.6 %
C. 97.6 TR
D. 65.65 %

Twin cylinder ammonia compressor with volume displacement of 14,726 cm^3 operates at 300 rpm. Condenser and evaporator pressure re 1200 Kpa and 227 Kpa respectively. Specific volume of refrigerant at the entrance of compressor is 528.26 kj/kg. compression process is polytropic with n = 1.20 and clearance factor of compressor is 2 percent. Determine horsepower required.

A. 60 HP
B. 70 HP
C. 80 HP
D. 90 HP

Reversed Carnot cycle has a refrigerating Cop of 2.5. determine the ratio TH/TL?

A. 1.4
B. 1.5
C. 1.25
D. 1.2

Three thousand cubic feet per minute of air are circulated over an air0cooled condenser. If the load of the condenser is 64,800 Btu/hr, compute the temperature rise of the air passing over the condenser specific volume of standard air (13.34 ft^3/lb)

A. 10 degF
B. 15 degF
C. 20 degF
D. 25 degF

Saturated vapor ammonia at -16 degC (h =1442.60 Kj/kg) leaves the evaporator and enters the compressor at -6 degC (h=1465 kj/kg). the refrigerant leaves the condenser as saturated liquid of 40 degC (h4 = 390.6 kj/kg) and enters the expansion valve at 35 degC (h3=366.1 kj/kg). heat rejects from the condenser amount to 50 KW. The work to compressor is 208 kj/kg, while the heat losses from compressor is 33 kj/kg. if 95 kj/kg of heat lost in the piping between the compress discharge and condenser inlet, determine the refrigerating capacity of the system.

A. 49.5 TR
B. 46.61 TR
C. 12.88 TR
D. 13.24 TR

In an actual refrigeration cycle using R12 as working fluid, the refrigerant flow rate is 0.05 kg/s. vapor enters the expansion valve at 1.15 Mpa, 40 degC (h=238.5 kj/kg) and leaves the evaporator at 175 KPa, -15 degC (h=345 kj/kg). the electric input to the motor driving the compressor is measured and found 3.0 KW. Motor efficiency at this load is 92% and mechanical efficiency 82%. Determine the actual coefficient of performance for this cycle.

A. 1.58

B. 2.36

C. 1.78

D. 1.34

An ammonia refrigeration system the temperature in the evaporator is -12 degC the ammonia at the evaporator entry is 0.1511 dry while at exit is 0.95 dry, if the rate if ammonia circulation is 5.64 kh/min, determine the refrigerating capacity of the system. Enthalpy of saturated liquid and vapor at -12 degC us 144,929 kj/kg and 1447.74 kj/kg respectively.

A. 17.82 TR
B. 34.82 TR
C. 27.82 TR
D. 4.82 TR

A two stage cascade vapor compression refrigeration system uses ammonia in the low-temperature loop and R-12 in the high-temperature loop. The ammonia provides 15 tons cooling. If the high-loop temperature requires 10.12 KW compressor power and low-loop 15.93 KW, determine the COP of the system.

A. 2.027 TR
B. 5.22 TR
C. 3.314 TR
D. 9.1 TR

When a man returns to his well-sealed house on a summer day, he find that the house is at 32 degC . he turns on the air conditioner, which cools the entire house to 20 degC in 15 mins. If COP of the air-conditioner system is 2.5, determine the power drawn by the air conditioners. Assume the entire mass within the house equivalent to 800 kg of air for which c = 0.72 kj/kg-C.

A. 7.68 KW
B. 3.07 KW
C. 19.2 KW
D. 12.03 KW

It is desired to double the COP of a reversed carnot engine for cooling from 5.0 by raising the temperature of heat addition while keeping the temperature of heat rejection constant. By what percentage must the temperature of heat addition he raised?

A. 10.1 %
B. 9.1 %
C. 8.1 %
D. 7.1 %

An ammonia water cooled compressor receives the refrigerant at specific volume 62 L/kg. it has a piston displacement rate of 5 m^3/min. if a squirrel cage motor running at 1200 rpm drives the compressor and a average piston speed is 490 m/min, calculate size of cylinder bore.

A. 20.4 cm
B. 26.0 cm
C. 16.13 cm
D. 13.6 cm

The Initial volume of an ideal gas is compressed to one-half its original volume and to twice its temperature the pressure,

A. Doubles
B. Quadruples
C. Remains constant
D. Halves

The gage pressure of a medium is 30 Kpa (vacuum) and the atmospheric pressure is 101.3 KPa, the absolute pressure will be;

A. 131.3 Kpa
B. -71.3 Kpa
C. 71.3 Kpa
D. -131.3 Kpa

If a particle has a velocity of 4 meters per second and a kinetic energy of 144 joules, then the mass, in kilograms of his particles must be;

A. 44
B. 16
C. 18
D. 24

A condenser vacuum gauge reads 715 mm HG when the barometric stands at 757 mm HG. State the absolute pressure in the condenser in KN/m^2 or KPa

A. 5.6 KPa
B. 5.9 Kpa
C. 6.5 Kpa
D. 5.2 KPa

Determine the force in newton in a piston of 465 mm^2 with a pressure of 0.172 MPa

A. 65 N
B. 72 N
C. 80 N
D. 111 N

One piston of a hydraulic press has an area of 1 cm^2. The other piston has an area of 25cm^2, if a force of 150 N is applied on the smaller piston, what will be the total force on the larger piston is both piston surface are the same level?

A. 6 N
B. 175 N
C. 3750 N
D. 4250 N

If the pressure of a confined gas at a constant temperature is tripled, what will happen to the volume?

A. The volume will be tripled
B. The volume will be reduced to one-third of its original value
C. The volume will remain unchanged
D. The volume is constant

The work done on air is 10.86 KJ/kg, determine the compressor power if it is receiving 272 kg/min if --- air

A. 36.72 HP
B. 49.23 HP
C. 2954 HP
D. 66 HP

A water tank of 18 ft wide, 14 ft long and 4 ft high, calculate the pressure at the bottom of the tank

A. 1.733 Psi
B. 1.999 Psi
C. 2.337 Psi
D. 3.773 Psi

The pressure of 750 mmHg in KN/m^2

A. 90
B. 100
C. 103
D. 110

A double purpose tank 18 ft wide, 24 ft long and 4 ft depth is filled with water. What is the weight of the water in the tank in long tons?

A. 49 Tons
B. 48 Tons
C. 54 Tons
D. 50 Tons

Oil Flow through a 16 tubes on a single cooler with a velocity of 2m/s. the internal diameter of the tube is 30mm and oil density is 0.85 gm/ml. find the volume flow in liters per sec.

A. 22.62
B. 32.22
C. 62.22
D. 42.62

A substance temperature was 620 degR. What is the temperature in degC?

A. 50.7
B. 45.54
C. 71.11
D. 94.44

Unknown volume of container gas of gas of 1 atmosphere is allowed to expand to another container of 10 m^3 volume at 500 mm Hg at constant temperatures. Find the unknown volume.

A. 6.58 m^3
B. 6.75 m^3
C. 5.67m^3
D. 7.65 m^3

An iron block weighs 5 Newton and has volume of 200 cm^3. What is the density of the block?

A. 2458 kg/m^3
B. 2485 kg/m^3
C. 2584 kg/m^3
D. 2549 kg/m^3

If air is at a pressure of 22.22 Psia and at temperature of 800 degR, what is the specific volume?

A. 11.3 ft^3/lbm
B. 33.1 ft^3/lbm
C. 13.3 ft^3/lbm
D. 31.3 ft^3/lbm

The specific gravity of mercury is 13.55. what is the specific weight of mercury?

A. 123.9 Kn/m^3
B. 139.2 Kn/m^3
C. 132.9 Kn/m^3
D. 193.2 Kn/m^3

The equivalent weight of mass 10 kg at location where the acceleration of gravity is 9.77 m/sec^2

A. 97.7 N
B. 79.9 N
C. 77.9 N
D. 977 N

Transportation company specializes in the shipment of pressurized gaseous material. An order is received for 100 liters of a particular gas at STP (32 degF and 1 atm). What minimum volume tank is necessary to transport the gas at 80 degF and maximum pressure of 8 atm?

A. 16 liters
B. 14 liters
C. 10 liters
D. 12 liters

100 g of water are mixed with 150 g of alcohol (density = 790 kg/m^3). What is the specific volume of the resulting mixtures, assuming that the fluids mixed completely?

A. 0.82 x 10^-3 cu.m/kg
B. 0.88 x 10 -3 cu.m/kg
C. 0.63 x 10 -3 cu.m/kg
D. 1.16 x 10 -3 cu.m/kg

How much does 30 lbm weigh in the moon (g=5.47 ft/s^2)

A. 2.0 lbf
B. 3.2 lbf
C. 3.4 lbf
D. 5.096 lbf

A 10 kg block is raised vertically 3 meters. What is the change in potential energy.

A. 320 J
B. 350 kg-m^2/s^2
C. 294 J
D. 350 N-m

How many cubic meter is 100 gallons of liquid

A. 3.7850 cu.m
B. 0.1638 cu.m
C. 0.3785 cu.m
D. 1.638 cu.m

Steam turbine is receiving 1014 lbm/hr of steam, determine the horsepower output of the turbine if the work done by steam is 251 btu/lbm

A. 100 HP
B. 462.7 HP
C. 200 HP
D. 6002.7 HP

What is the resulting pressure when one pound of air at 15 psia and 200 degF is heated at constant volume heated to 800 degF?

A. 52.1 Psia
B. 15 Psia
C. 28.6 Psia
D. 36.4 Psia

A bicycle tire has a volume of 600 cm^3. It is inflated with carbon dioxide to pressure of 551.43 Kpa _ 20 degC how many grams of CO2 are contained in the tire? R=0.18896 kj/kg-K

A. 5.98 g
B. 6.43 g
C. 4.63 g
D. 3.83 g

The absolute pressure at the bottom of a vertical column of water is 15.5 psia. What is the height of this column?

A. 22 in
B. 9.2 in
C. 12 in
D. 9.8 in

A water temperature rise of 18 degF in the water cooled condenser is equivalent in degC to ---

A. 7.78 degC
B. 10 degC
C. 263.56 degK
D. -9.44 degC

An oil storage tank contains oil with specific gravity of 0.88 and depth of 20 meters. What is the hydrostatic pressure at the bottom of the tank in kg/cm^2?

A. 1.67
B. 1.76
C. 1.56
D. 1.87

A vertical column of water will be supported to what height by standard atmospheric pressure?

A. 34 ft
B. 36 ft
C. 24 ft
D. 26 ft

The specific weight of liquid is 60 lb/ft^3 what is the equivalent to Kn/m^3

A. 9.334
B. 9.249
C. 9.643
D. 9.420

A cylinder weighs 150 lbf. Its cross0sectional area is 50 square inches, when the cylinder stands vertically on one end, what pressure does the cylinder exert on the floor?

A. 141 Kpa
B. 58,2 Kpa
C. 0.258 bar
D. 0.141 bar

What is the absolute pressure exerted on the surface of a submarine cruising 300 ft below the free surface of the sea? Assume specific gravity of sea water is 1.03

A. 133.9 Psia
B. 148.6 Psia
C. 100.7 Psia
D. 103.7 Psia

Air enters a nozzle steadily at 2.21 kg/m^3 and 30 m/s . What is the mass flow rate through the nozzle if the inlet area of the nozzle is 80 cm^2?

A. 0.35 kg/s
B. 3.5 kg/s
C. 5.3 kg/s
D. 0.53 kg/s

The work required to accelerate an 800 kg car from rest to 100 km/h on a level road;

A. 308.6 Kj
B. 806.3 Kj
C. 608.3 Kj
D. 386 Kj

Assuming that there are no heat effects and no friction effects, find the speed of a 3220-lbm body after it falls 778 ft from rest

A. 422 ft/sec
B. 424 ft/sec
C. 224 ft/sec
D. 424 ft/sec

What is the flow rate through a pipe 4 inches in diameter carrying water at a velocity of 11 ft/sec?

A. 430.84 gpm
B. 7.18 gpm
C. 340.28 gpm
D. 39.16 gpm

If the specific weight of a liquid is 58.5 lbf per cubic foot, what is the specific volume of the liquid in cm^3/g?

A. 0.5321 cm^3/g
B. 0.6748 cm^3/g
C. 0.9504 cm^3/g
D. 1.0675 cm^3/g

What is the resulting pressure when one pound of air at 0.3 psig and 200 degF is heated at constant volume to 800 degF?

A. 0.572 psig
B. 28.6 psia
C. 7.857 psia
D. 1.2 psig

A small pump serving as model, when tested in laboratory using water at 3600 rpm, delivered 3.0 cfs at a head of 125 ft. if the efficiency of this model pump is 84%. Predict the horsepower input to the prototype pump if it is develop the same heads as model pump and the model pump has scale ratio of 1:10. Assume the efficiency of the prototype pump is 90%.

A. 50.6 HP
B. 4730 HP
C. 3740 HP
D. 60.5 HP

Pump at its best efficiency (BEP) has a capacity of 10,500 gpm while developing a head of 60 ft
A rotative speed of 1450 rpm. What is the specific speed of the pump?

A. 2760
B. 1450
C. 2476
D. 6892

A pump will be installed below the reservoir water surface with a required net positive suction head (NPSH) of 50 ft. the barometric pressure is 14.3 Psia and the vapor pressure is 0.5 psia. Assume friction losses in the intake piping are 5 ft. find the maximum allowable elevation of the pump relative to the water surface intake to avoid cavitation.

A. 45 ft
B. 55 ft
C. 18.2 ft
D. 23.2 ft

Centrifugal pump at best efficiency point (BEP). Assume the pump characteristics are head, h= 7m , flow rate, Q = 19 liters/sec, and rotative speed n=1170 rpm. Find the specific speed in SI units.

A. 0.4
B. 0.71
C. 10.41
D. 3.94

15 in. diameter fan operates at 1600 rpm and develops a head of 6 in. of water and delivers 120 cfm. What volumetric capacity for geometrically similar fan that will develop 6 in. of water at 1300 rpm?

A. 147.70 cfm
B. 181.8 cfm
C. 97.5 cfm
D. 79.2 cfm

Radial flow pump operating at maximum efficiency at a specific speed of 2500 is deliver 260 rpm against a head of 129 ft at a rotative speed of 2100 rpm find the required number of stages (I,e impellers)

A. 2 stages
B. 3 stages
C. 4 stages
D. 5 stages

How many identical turbines, operating at 139.0 rpm and 91% efficiency (specific speed = 5.4), are needed to exploit a head of 1200 ft and a flow of 1660 ft^3/s

A. 2 turbines
B. 3 turbines
C. 4 turbines
D. 5 turbines

How many poles should be a 60-Hz generator have, if it is connected to a turbine operating under a design head of 3000 ft with a flow of 82 cfs? Assume turbine specific speed and efficiency 3 and 84 percent respectively.

A. 10 pole
B. 12 pole
C. 14 pole
D. 16 pole

It is proposed to build a dam in a river where the flow rate is 10 m^3/sec and a 32-m drop in elevation can be achieved for flow through a turbine. If the turbine is 82% efficient, what is the maximum power that can be achieved? Specific gravity of river water is 0.998

A. 2570 KW
B. 3133 KW
C. 3820 KW
D. 262 Kw

What type of turbine delivers 25,000 bhp at 500 rpm under a net head of 5350 ft

A. Impulse turbine
B. Francis turbine
C. Kaplan turbine
D. Propeller turbine

A 26-hp delivers 475 gpm of gasoline (w= 42.5 lb/ft^3) at 20 deg C with 78% efficiency. what pressure rise result across the pump?

A. 30.2 psi
B. 32.7 psi
C. 120.3 psi
D. 73 psi

A model pump delivering water at 180 degF (w= 60.6 lb/ft^3; p(vapor) = 7.54 Psia) at 900 gpm and 2500 rpm begins to cavitate the inlet pressure and velocity are 13 psia and 22 fps. Find the required NPSH of a protype which is 4 times larger and runs at 1100 rpm.

A. 63.5 ft
B. 20.49 ft
C. 6.61 ft
D. 36 ft

The diameter of the discharge pipe is 8 in. and that of the intake pipe is 10 in. the pressure gage at discharge reads 32 psi, and vacuum gage at the intake reads 12 in HG, if the discharge flow rate = 4.0 ft^3/s of water and the brake power horsepower is 49, find the efficiency. The intake and the discharge are at the same elevation.

A. 82.1 %
B. 80.9 %
C. 55.8 %
D. 58.46 %

A piston positive- displacement pump (PDP) has 6-in diameter and a 2.5-in stroke. Is crankshaft rotates at 300 rpm. Calculate its output at 94 percent volumetric efficiency.

A. 12.27 cfm
B. 13.5 cfm
C. 10 cfm
D. 11.53 cfm

A centrifugal pump (efficiency 88%) lifts water through a total height of 40 m from reservoir to discharge. Pumping is through 300 m of 75mm diameter pipe at the rate of 20 liter/sec. if pipe friction factor f= 0.025, what horsepower is required?

A. 28.4 KW
B. 32.2 KW
C. 25 KW
D. 9 kW

In order to predict the behavior of a small oil pumps, tests are to be made on a model using air. The other pump is to be driven by a 1/20 HP motor at 1800 rpm and a ¼ HP motor is available to drive the air pump at 600 rpm. Using specific gravity of oil at 0.912 and density of air constant at 0.076 lb/ft^3, what size model should be built?

A. The model should be 2 times as large as the oil pump
B. The model should be 5 times as large as the oil pump
C. The model should be 8 times as large as the oil pump
D. The model should be 10 times as large as the oil pump

A double-overhung impulse-turbine installation is to develop 20,000 hp at 275 rpm under a net head 100 ft. determine the specific speed.

A. 4.34
B. 6.14
C. 203.61
D. 144

An impulse wheel at best produces 125 HP under a head of 2.0 ft. by what percent should the speed increased for a 290 ft-head?

A. 82.5%
B. 17.5%
C. 72.41%
D. 13.5%

What is the power ratio of a pump and its 1/5 scale model if the ratio of heads is 4 to 1?

A. 20
B. 200
C. 12.5
D. 125

The speed of a centrifugal pump is doubled. By what factor does the pump head change?

A. 0.125
B. 0.25
C. 4
D. 8

Compute the specific volume of an air-vapor mixture in cubic meters per kilogram of dry air when the following conditions prevail; t = 40 degC, w = 0.015 kg/kg, and P=100 Kpa

A. 0.99 m^3/kg
B. 0.89 m^3/kg
C. 0.79 m^3/kg
D. 0.69 m^3/kg

A coil has an inlet temperature of 70 degF and outlet of 80 degF, if the mean temperature of the coil is 130 degF, find the bypass factor of the coil.

A. 0.28
B. 1.20
C. 0.82
D. 0.83

Compute the pressure drop of 35 degC air flowing with a mean velocity of 5 m/s in a circular sheet-metal duct 100 mm in diameter and 25m long. Use a friction factor, f= 0.04 and p=1.3799 kg/m^3.

A. 431.22 Pa
B. 221.34 Pa
C. 312.22 Pa
D. 422. 31 Pa

A pressure difference of 400 Pa is available to force 20 degC air through a circular sheet-metal duct 450mm. In diameter and 25m long. At 20 degC, p=1.204 kg/m^3 and take friction factor, f=0.016. Determine the velocity.

A. 27.43 ft/s
B. 43.72 ft/s
C. 89.68 ft/s
D. 86.98 ft/s

A rectangular duct has a dimension of 0.25 m by 2m. Determine the equivalent diameter of the duct.

A. 0.50 m
B. 0.60 m
C. 0.70 m
D. 0.40 m

To what height will a barometer column rise if the atmospheric conditions are 13.9 psia and 68 degF and barometric fluid is mercury ?

A. 3.56 ft/s
B. 5.36 ft/s
C. 2.36 ft/s
D. 3.26 ft/s

To what height will a barometer column rise if the atmospheric conditions are 13.9 psia and 68 degF and barometric fluid is ethyl alcohol ? Note: @ 68degF; Pv=138.5 lbf/ft^2 and specific gravity of 0.79 for ethyl alcohol.

A. 79.37 in.
B. 37.79 in.
C. 353.54 in.
D. 453.53 in.

What is the pressure 7000 ft below the water surface of the ocean ? Neglect compressibility.

A. 512 000 psf
B. 324 500 psf
C. 447 000 psf
D. 213 000 psf

Atmospheric air 14.7 psia and 60 degF at sea level, what is the pressure at 14 212 ft. altitude. If air is compressibility. ? Note: @ 60 degF; the density of air is 0.0763 lbm/ft^3; P1=14.7 psia

A. 5.4674 psia
B. 7.5304 psia
C. 7.1696 psia
D. 7.1966 psia

Water (p=62.4 lbm/ft^3) is flowing through a pipe. A pitot-static gage registers 3.0 inches of mercury. What is the velocity of the water in the pipe ? Note: Phg= 848.6 lbm/ft^3.

A. 14.7 ft/s
B. 41.7 ft/s
C. 71.4 ft/s
D. 74.1 ft/s

The mass of an outside air at 50degC in an air conditioning unit is 60kg. find the temperature after mixing if the outside air mixed with 40kg with recirculated air at 35degC.

A. 44 degC
B. 39 degC
C. 52 degC
D. 47 degC

A creamery must cool 20,000 liters of milk received each day from initial temperature of 29 degC to a final temperature of 2 degC n 5hrs. If the refrigeration loses amount to 10 % of the cooling load, what must be the capacity of the refrigerating machine ?

A. 38.5 TOR
B. 36.5 TOR
C. 37.5 TOR
D. 39.5 TOR

How many tons of refrigerant are required to produce 10 metric tons of ice per day at-10 degC from raw way at 22 degC. If miscellaneous losses are 15% of the chilling and freezing load?

A. 17 TOR
B. 20 TOR
C. 15 TOR
D. 24 TOR

Five hundred kilograms of poultry enter a chilled to s final temperature of -18degC for storage in 15hrs. The specific heat above and below freezing are 3.18 kj/kg degC and 1.55 kj/kg degC respectively. The latent heat is 246 kj/kg and the freezing temperature is -5 degC. Compute the product load.

A. 2.75 KW
B. 2.85 KW
C. 2.95 KW
D. 3.15 KW

Fish weighing 11,000 kg with a temperature of 20 degC is brought to a cold storage and which shall be cooled at 10 degC in 11hrs. Find the required plant refrigerating capacity in tons of refrigeration if the specific heat of fish is 0.7 Kcal/kg degC above freezing and 0.30 Kcal/kg degC below freezing point which is -3degC. The latent heat freezing is 55.5 Kcal/kg.

A. 25.26 TOR
B. 15.26 TOR
C. 14.38 TOR
D. 24.38 TOR

The power requirement of a carnot refrigerator in maintaining a low temperature region at 300 K is 1.5 kw per ton. Find the heat rejected ?

A. 4.02 KW
B. 7.02 KW
C. 5.02 KW
D. 6.02 KW

A vapor compression refrigeration systym is designed to have a capacity of 150 tons of refrigeration. It produces chilled water from 22 degC to 2 degC. Its actual coefficient of performance is 5.86 and 35% of the power supplied to the compressor is lost in the form of friction and cylinder cooling losses. Determine the condenser cooling water required for a temperature rise of 10 degC.

A. 14.75 kg/s
B. 15,65 kg/s
C. 18.65 kg/s
D. 13.75 kg/s

Determine the heat extracted from 2000 kg of water from 25 degC to ice at -10 degC.

A. 621,150 kj
B. 721,150 kj
C. 821 ,150 kj
D. 921,150 kj

A single acting, twin cylinder, ammonia compressor with bore equal to stroke is driven by an engine at 250 rpm. The machine is installed in a chilling plant to produce 700 kw of refrigeration at -18degC evaporating temperature. At this temperature the cooling effect per kg mass is 1160 kj. The specific volume of vapor entering the compressor is 0.592 m^3 per kilogram. Assume 85% volumetric efficiency, determine the bore in mm.

A. 400 mm
B. 300 mm
C. 450 mm
D. 500 mm

An iron block weight 7 newtons and has a volume of 200 cubic centimeters. What is the density of the block.

A. 3465 kg/m^3
B. 3565 kg/m^3
C. 1255 kg/m^3
D. 2550 kg/m^3

The density of the gas is 0.003 slugs per cubic foot what is the specific weight of the gas?

A. 9.04 N/m3
B. 15.2 N/m3
C. 76.3 N/m3
D. 98.2 N/m3

The specific gravity of mercury relative to water is 13.5. what is the specific weight of mercury ? (the specific weight of water is 62.4 lbf per cubic foot.)

A. 82.2 kN/m3
B. 102.3 kN/m3
C. 132.9 kN/m3
D. 150.9 kN/m3

The specific weight of a liquid is 58.5 lb per cubic foot, what is the specific volume of the liquid ?

A. 0.5321 cm3/g
B. 0.6748 cm3/g
C. 0.9504 cm3/g
D. 1.0675 cm3/g

Which of the following are not units of pressure ?

A. Pa
B. Bars
C. Kg/m.s^2
D. Kg/m^2

A cylinder weight 150 lb. its cross-section area is 40 square inches. When the cylinder stand vertically on one end, what pressure does the cylinder exert on the floor ?

A. 14.1 kpa
B. 25.8 kpa
C. 63.2 kpa
D. 89.7 kpa

What pressure is a column of water 100 centimeters high equivalent to ?

A. 9810 Dyne/cm2
B. 9810 N/m2
C. 0.1 bars
D. O.1 atm

Water is flowing in a pipe with a radius of 10” at a velocity of 5m/s. at the temperature in the pipe, the density and viscosity of the water are as follows:

P=997.9 kg/m3
U=1.131 pa.s

What is the Reynold’s number for this situation?

A. 44.1
B. 88.2
C. 1140
D. 2241

How long must a current of 5.0 amperes pass through a 10 ohm resistor until a charge of 1200 coulombs passes through ?

A. 1 min
B. 2 min
C. 3 min
D. 4 min

A car moving at 70 km/hr has a mass of 1700 kg. what force is necessary decelerate it at rate of 0.4 m/s2.

A. O.680 N
B. 42.5 N
C. 680 N
D. 4250 N

One hundred millimeters of water in a plastic bag negligible mass is to be catapulted upwards with an initial acceleration of 20.0 m/s2. What force is necessary to do this ? assume that gravity is 9.81 m/s2 and the density of water is 1 g/cm3.

A. 2.00 N
B. 2.98 N
C. 15.0 N
D. 2.00 N

A boy pulls a sled with a mass of 20kg horizontally over a surface with a coefficient of friction of 0.20. it takes him 10 minutes to pull the sled 100 yards. What is his average power output over these 10 minutes ?

A. 4 W
B. 6 W
C. 8 W
D. 10 W

A force of 200lb acts on a block at an angle of 28 deg. With respect to horizontal. The block is pushed 2 feet horizontally. What is the work done by this force?

A. 215 J
B. 320 J
C. 480 J
D. 540 J

Two particles collide, stick together , and continue their motion together.Each particle has a mass of 10 g, and their respective velocities before the collision were 10 m/s and 100 m/s. what is the energy of the system after the collision ?

A. 21.8 J
B. 30.2 J
C. 42.8 J
D. 77.9 J

A copper bar is 90 centimeters long at 80 degF. What is the increase in its length when the bar is heated to 95 degF. The linear expansion coefficient for copper, alpha, is 1.7x10^-5 1/degC.

A. 2.12x10-5 m
B. 3.22x10-5 m
C. 5.25x10-5 m
D. 7.65x10-5 m

Calculate the energy transfer ate across a 6” wall of firebrick with a temperature difference across the wall of 50degC. The conductivity of firebrick is 0.65 BTU/hr-ft-degF at the temperature of interest.

A. 112 W/m2
B. 285 W/m2
C. 369 W/m2
D. 429 W/m2

A house has brick walls 15 millimeters thick. On a cold winter day, the temperature f the inner and outer surface of the walls are measured and found to be 20 degC and -12 degC, respectively. If there is 120 m2 of exterior wall space, and the thermal conductivity of bricks is 0.711 j/m.s.degC. how much heat is lost through the walls per hour ?

A. 182 J
B. 12.5 J
C. 655 J
D. 655 MJ

If a one-third horse power pump runs for 20 minutes, what is the energy used ?

A. 0.06 ergs
B. 0.25 Kw
C. 0.30 MJ
D. 0.11 Kw.h

A power of 6kw is supplied to the motor of a crane. The has an efficiency of 90%. With what constant speed does the crane lift an 800 lb,weight ?

A. 0.09 cm/s
B. 0.32 cm/s
C. 0.98 cm/s
D. 1.52 cm/s

An engine has an efficiency of 25%. It uses 2 gallons of gasoline per hour. Gasoline Has a heating value of 20,500 BTU/lbm and a specific gravity of 0.8. what is the power output of the engine ?

A. 0.33 Kw
B. 20.8 Kw
C. 26.0 Kw
D. 41.7 Kw

Two liters of an ideal gas, at a temperature of t1=25 degC and a pressure of P1=0.101 Mpa, are in a 10 cm diameter cylinder with a piston at one end. The piston is depressed, so that the cylinder is shortened by 10 centimeters. The temperature increases by 2 degC. What is the change in pressure ?

A. 0.156 MPA
B. 0.,167 MPA
C. 0.251 MPA
D. 0.327 MPA

What is the average power output of this engine ?

A. 89.5 N/s
B. 89.5 KW
C. 89.5x10^3 j. m/s
D. 89.5 KJ

What is the power required to transfer 97,000 coulombs of charge through a potentials rise of 50 volts in one hour?

A. 0.5 KW
B. 0.9 KW
C. 1.3 KW
D. 2.8 KW

A current of 7 amperes passes through a 12 ohm resistor. What is the power dissipated in the resistor ?

A. 84 KW
B. 0.59 hp
C. 0.79 hp
D. 7 hp

What is the pressure at point A in the tank if h=2 feet? (g=32.3 ft/sec2, and p=1.94 slug/ft3)

A. 75 lbf/ft2
B. 85 lbf/ft2
C. 100 lbf/ft2
D. 125 lbf/ft2

Determine the average velocity through a circular section in which the velocity distribution is given if a v=Vmax[1-(R/Ro)^2]. The distribution is symmetric with respect to the longitudinal axis, r=0, Ro is the outer radius, Vmax is the velocity along the longitudinal axis.

A. Vmax/4
B. Vmax/3
C. Vmax/2
D. Vmax

A pipe has a diameter of 4” at section AA, and a diameter of 2” at section BB. For an ideal fluid flow, the velocity is given as 1 ft/sec at section AA. What is the flow velocity at section BB?

A. 4 ft/sec
B. O.5 t/sec
C. 1.o t/sec
D. 2.0 t/sec

A mixing tank mixes two inlet streams containing salt. The salt concentration in stream 1 is 5% by weight, and stream 2 it is 15% by weight. Stream 1 flows at 25 kg/s , and stream 2 flows at 10 kg/s. there is only one exit stream. Find the salt concentration in the exit stream?

A. 5%
B. 8%
C. 11%
D. 13%

Water is pumped at 1 m^3/s to an elevation of 5 meters through a flexible hose using a 100% efficient pump rated at 100 kilowatts. Using the same length of hose, what size motor is needed to pump 1m^3/s of water to a tank with no elevation gain? In both cases both ends of the hose are at temperature pressure. Neglect kinetic energy effect.

A. 51 KW
B. 22 KW
C. 36 KW
D. 43 KW

A fluid with a kinetic viscosity of 2.5x10^-5 ft2/sec is flowing at 0.1 ft/sec from an orifice 3” in diameter. How can a fluid be described ?

A. The fluid is completely turbulent
B. The fluid is in transition zone
C. The fluid is laminar
D. Turbulent cannot be calculated; it must be measured

The Reynolds number of a sphere falling in air is 1x10^6. If the sphere's radius is 1ft, what is its velocity? (P air=0.00234 slug/ft3, U air=3.8x10lbf-sec/ft3)

A. 2.5 ft/sec
B. 5.1 ft/sec
C. 40.6 ft/sec
D. 81.2 ft/sec

The flow rate of water through a cast iron is 5000 gallons per mnute. The diameter of the pipe is 1 foot, and the coefficient of friction is f=0.0173. what is the pressure drop over a 100 foot length of pipe ?

A. 21.078 lbf/ft2
B. 23.78 lbf/ft2
C. 337.26 lbf/in2
D. 337.26 lbf/ft2

A cylindrical flash tank mounted with its axis horizontal is used to separate liquid ammonia from ammonia vapor. The ammonia vapor bubbles through the liquid with 70 m3/min leaving the disengaging surface. The disengaging rate is limited to 60 m/min and the liquid level is to operate with the liquid level one-third of the diameter from the top. Determine the diameter if the tank is 1.5 m long.

A. 830 mm

B. 730 mm

C. 860 mm

D. 760 mm

A 150 HP motor is used to drive a compressor. If the heat loss from the compressor is 25 KW and the mass flow rate of the refrigerant entering the compressor is 0.50 kg/s, determine the difference of the enthalpies between the inlet and outlet of the compressor.

A. 143.80 kj/kg
B. 153.80 kj/kg
C. 173.80 kj/kg
D. 183.80 kj/kg

To cool farm products, 300 kg of ice at -4.4 degC are placed in bunker. Twenty four hours late the ice have melted into water at 7.2 degC. what is the average rate of cooling provided by the ice in kj/kh?

A. 2679.28 kj/hr
B. 5679.28 kj/hr
C. 3679.28 kj/hr
D. 4679.28 kj/hr

Determine the estimated condenser load for an open type compressor having a cooling capacity of 16,500 Btu/hr and a heat rejection factor of 1.32.

A. 22,280 Btu/hr
B. 20,780 Btu/hr
C. 21,780 Btu/hr
D. 19,780 Btu/hr

If the load on water-cooled condenser in 150,000 Btu/hr and the temperature rise of te water in the condenser is 10 degF, what is the quantity of water circulated in gpm?

A. 30 GPM
B. 40 GPM
C. 20 GPM
D. 50 GPM

The load on a water-cooled is 90,000 Btu/hr. if the quantity of water circulated through the condenser is 15gpm, determine the temperature rise of the water in the condense.

A. 12 degF
B. 14 degF
C. 16 degF
D. 18 degF

The weight of ammonia circulated in a machine is found to be 21.8 lb/hr. if the vapor enters the compressor with a specific volume of 9.4 ft3/ld, calculate the piston displacement ,assuming 80% volume efficiency.

A. 261.6 ft3/hr
B. 271.6 ft3/hr
C. 281.8 ft3/hr
D. 291.6 ft3/hr

A single-stage ammonia stage compressor is producing 10 tons of refrigeration and the power consumed is 15 HP. Suction pressure is 25psi, condensing pressure is 180 psi. Brine temperature is 20 degF off brine cooler. Determine the actual coefficient of performance.

A. 10.14
B. 11.14
C. 12.14
D. 13.14

In an ammonia condensing machine (compressor plus condenser) the water used for condensing is 55 degF and the evaporator is at 15 degF. Calculate the ideal COP.

A. 11.875
B. 12.875
C. 10.875
D. 13.875

How much refrigeration capacity is required to cool 2000 cfm of air from 85 degF to 70 degF ?

A. 2.7 TOR
B. 3.7 TOR
C. 1.7 TOR
D. 4.7 TOR

Determine the coil face area required to maintain a face velocity of 400 ft/min. if the air flow rate over the coil is 2100 ft3/min.

- 3.25 ft2
- 4.25 ft2
- 5.25 ft2
- 6.25 ft2

Calculate the heat transfer per hour through a solid bricks wall 6m long, 1.9m high, and 225 mm thick, when the outer surface is at 5 degC and the inner surface 17 degC, the coefficient of thermal conductivity o the bricks being 0.6 W/m-K.

A. 2,004.48 kJ
B. 3,004.48 kJ
C. 2,400.48 kJ
D. 3,400.48 kJ

A vertical furnace wall is made up of an inner wall of firebrick 20cm thick followed by insulating brick 15 cm thick and an outer wall of steel 1 cm thick. The surface temperature of the wall adjacent to the combustion chamber is 1200 degC while that of the outer surface of steel is 50 degC. The thermal conductivities of the wall material in W/m-k are firebrick, 10; insulating brick, 0.26; and steel,45. Neglecting the film resistances and contact resistance of joints, determine the heat loss per sq.m. of wall area.

A. 1.93 W/m2
B. 2.93 W/m2
C. 1.55 W/m2
D. 2.55 W/m2

A composite wall is made up of an external thickness of brickwork 110 mm thick inside which is a layer of fireglass 75 mm thick. The fireglass is faced internally by an insulating board 25 mm thick. The coefficient of thermal conductivity for the three are as follows;

Brickwork	1.5 W/m-k
Fireglass	0.04 W/m-k
Insulating board	0.06 W/m-k

The surface transfer coefficient of the inside wall is 3.1 W/m2-k while that of the outside wall is 2.5 W/m2-k. take the internal ambient temperature as 0 degC and the external temp. is 27 degC. Determine the heat loss through such wall 6 m high and 10 m lng.

A. 330.10 W
B. 230.10 W
C. 430.10 W
D. 530.10 W

One insulated wall of a cold- storage compartment is 8m long by 2.5 high and consists of an outer steel plate 18 mm thick. An inner wood wall 22.5 mm thick, the steel and wood are 90 mm apart to form a cavity which is filled with cork. If the temperature drops across the extreme faces of the composite wall is 15 degC. Calculate the heat transfer per hour through the wall and the temperature drop across the thickness of the cork. take the coefficient of thermal conductivity for steel, cork and wood as 45, 0.045, and 0.18 W/m-k respectively.

A. 408.24 KJ, 12.12 degC
B. 708.24 KJ, 11.12 degC
C. 608.24 KJ, 13.12 degC
D. 508.24 KJ, 14.12 degC

A furnace wall consist of 35 cm firebrick (k = 1.557 W/m-k) , 12 cm insulating refractory (k = 0.346) and 20 cm common brick (k = 0.692) covered with 7 cm steel plate(k = 45) . the temperature at the inner surface of the firebrick is 1,230 degC and at the outer face of the steel plate is 60 degC. Atmosphere 27 degC. What is the value of the combined coefficient convection and radiation from the outside wall?

A. 31.13 W/m^2-K
B. 30.13 W/m^2-K
C. 41.3 W/m^2-K
D. 40.13 W/m^2-K

Hot gases at 280 degC flow on one side of a metal plate of 10mm thickness and air at 35 degC flows the other side. The heat transfer coefficient of the gases is 31.5 W/m^2-k and that of the air is 32 W/m^2-K. calculate the over all transfer coefficient.

A. 15.82 W/m^2-K
B. 16.82 W/m^2-K
C. 14.82 W/m^2-K
D. 17.82 W/m^2-K

The surface temperature of the hot side of the furnace wall is 1200 degC. It is desired to maintain the outside of the wall at 38 degC. A 152 mm of refractory slice is used adjacent to the combustion chamber and 10 mm of steel covers the outside. What thickness of insulating bricks is necessary between refractory and steel, if the heat loss should be kept at 788 W/m^2?

A. 220 mm
B. 240 mm
C. 260 mm
D. 380 mm

An insulated steam pipe located where the ambient temperature is 32 degC, has an inside diameter of 50 mm with 10 mm thick wall. The outside diameter of the corrugated asbestos insulation is 125 mm and the surface coefficient of still air , ho = 12 W/m^2-K. inside the pipe is steam having a temperature of 150 degC with film coefficient of hi = 6000 W/m^2-K. thermal conductivity of pipe and asbestos insulation are 45 and 0.12 W/m-K respectively. Determine the heat loss per unit length of pipe.

A. 110 W
B. 120 W
C. 130 W
D. 140 W

How many watts will be radiated from a spherical black body 15 cm in diameter at a temperature of 800 degC?

A. 5.34 KW
B. 4.34 KW
C. 6.34 KW
D. 3.34 KW

A wall with an area of 10 m^2 is made of 2 cm thickness of white pine (k=0.113 W/m^2-C) followed by 10 cm of brick (k=0.649 W/m-C). the pine us in the inside where the temperature is 30 degC while the outside temperature is 10 degC. Assuming equilibrium conditions exist, what is the temperature at the interface between the two metals?

A. 15.55 degC
B. 17.54 degC
C. 18.21 degC
D. 19.31 degC

A counter flow heat exchanger is designed to heat fuel oil from 45 degC to 100 degC while the heating fluid enters at 150 degC and leaves at 155 degC. Calculate the arithmetic mean temperature difference.

A. 40 degC
B. 50 degC
C. 60 degC
D. 70 degC

With three different quantities x,y, and z of the same kind of liquid of temperature 9,21 and 38 degC respectively, it is found that when x, and y are mixed together the resultant temperature is 17 degC and when y and z are mixed together the resultant temperature is 28 degC. Find the resultant temperature if x and z were mixed.

A. 29.87 degC
B. 25.92 degC
C. 20.85 degC
D. 24.86 degC

The journals of a shaft are 380 mm diameters, it runs at 150 rpm the coefficient of friction between journals and bearing is 0.02. if the average load on the bearing is 200 KN, find the heat generated per minute at the bearing.

A. 501.375 KJ
B. 505.575 KJ
C. 401.375 KJ
D. 501.575 KJ

A reversible Carnot cycle requires 3 hp and extracts energy from a lake to heat a house. If the house is kept at 70 degF and requires 2000 btu per minute, what is the temperature of the lake?

A. 35.29 degF
B. 36.29 degF
C. 39.29 degF
D. 40.29 degF

An oxygen cylinder of volume 2.3 ft^3 has a pressure of 2200 psig and is at 50 degF. Determine the mass of oxygen in the cylinder.

A. 25,66 Lbs
B. 26.66 Lbs
C. 27.66 Lbs
D. 28.66 Lbs

A group of 50 persons attend a secret meeting in room which is 12m wide by 10m long and a ceiling height of 3m. the room is completely sealed off and insulated. Each person gives off 150 Kcal per hour of heat and occupies a volume of 0.20 m^3. The room has an initial pressure of 101.3 Kpa and temperature of 16 degC. Calculate the room temperature after 10 minutes. Use R=0.287 Kj/kg-K and Cv=0.171 Kcal/kg-K.

A. 33.1 degC
B. 37.7 degC
C. 38.7 degC
D. 31.7 degC

One kilogram of wet steam at a pressure of 8 bar and dryness of 0.94 is expanded until the pressure is 4 bar. If expansion follows the law $PV^n=C$, where $n = 1.12$, find the dryness fraction of the steam at the lower pressure.

A. 0.9072
B. 0.4197
C. 0.2260
D. 0.2404

2.5 liters of superheated steam at 25 bar and 400 degC is expanded in an engine to a pressure of 0.1 bar when its dryness fraction is 0.9. find the final volume of the steam.

A. 163.74 liters
B. 263.74 liters
C. 363.74 liters
D. 463.74 liters

A 1.5 kg of wet steam at a pressure of 5 bar dryness 0.95 is blown into 70 liters of water of 12 degC. Find the final enthalpy of the mixture.

A. 74.80 KJ/kg
B. 84.80 Kj/Kg
C. 94.80 Kj/kg
D. 104.80 Kj/kg

A 640 BHP diesel engine uses fuel oil of 28 deg API gravity, fuel consumption us 0.65 lb/BHP-hr. cost of fuel is P 7.95 per liter. For continuous operation, determine the minimum volume of cubical day tank in cm^3, ambient temperature is 45 degC.

A. 4,372,890 cm^3
B. 5,987,909 cm^3
C. 5,291,880 cm^3
D. 7,352,789 cm^3

A typical industrial fuel oil C16H32 with 20% excess air by weight. Assuming complete oxidation of the fuel, calculate the actual air-fuel ratio by weight.

A. 17.56 kg air/kg fuel
B. 15.76 kg air/ kg fuel
C. 16.75 kg air/kg fuel
D. 17.65 kg air/ kg fuel

Fuel oil in a day tank for use of an industrial boiler is tested with hydrometer. The hydrometer reading indicate a S.G = 0.924 when the temperature of the oil in the tank is 35 degC. Calculate the higher heating value of the fuel.

A. 43,852.13 Kj/kg
B. 53,852.13 Kj/Kg
C. 58,352.13 Kj/Kg
D. 48,352.13 Kj/Kg

A diesel electric plant supplies energy for meralco. During a 24 hr period, the plant consumed 200 gallons of fuel at 28 degC and produced 3930 KW-hr. industrial fuel used is 28 deg API and was purchased at P 5.50 per liter at 15.6 degC. What should be the cost of fuel be produced one KW-hr?

A. P 1.05
B. P 1.10
C. P 1.069
D. P 1.00

A certain coal has the following ultimate analysis:

C = 70.5%	H = 4.5 %	O2 = 6% N2 = 1.0 %
S = 3.0 %	Ash = 11 %	Moisture = 4%

A stoker fired boiler of 175,000 kg/hr steaming capacity uses this coal as fuel. Calculate the volume of air in m^3/hr with air at 60 degF (15.6 degF) and 14.7 psia (101.325 Kpa) the coal is burned with 30 % excess air. boiler efficiency of 70 % and factor of evaporation of 1.10.

A. 212, 861.04 m^3/kg
B. 221, 861.04 m^3/kg
C. 218,261.04 m^3/kg
D. 281,261.04 m^3/kg

Diesel power plant consumed 1 m^3 of fuel with 30 Deg API at 27 degC in 24 hrs. calculate the fuel rate in kg/hr.

A. 840 kg/m^3
B. 873 kg/m^3
C. 970 kg/m^3
D. 940 kg/m^3

Diesel power plant consumed 1 m^3 of fuel with 30 Deg API at 27 degC in 24 hrs. calculate the fuel rate in kg/hr.

A. 36.21
B. 26.25
C. 29.34
D. 39.42

A water tube boiler has a capacity of 1000 kg/hr of steam. The factor of evaporation is 1.3 boiler rating is 200%, boiler efficiency is 65% heating surface area is 0.91 m^3 per bo.Hp, and the heating value of fuel is 18,400 Kcal/kg. the total coal available in the bunker is 50,000 kg. determine the no, of hrs to consume the available fuel.

A. 853.36 hrs
B. 706.57 hrs
C. 979.46 hrs
D. 100.75 hrs

Two boilers are operating steadily on 91,000 kg of coal contained in a bunker. One boiler is producing 1591 kg of steam per hour at 1.2 factor of evaporation and an efficiency of 65% and another boiler produced 1364 kg of steam per hour and 1.15 factor of evaporation and an efficiency of 60%. How many hours will the coal in the bunker run the boiler if the heating value of the coal is 7,590 Kcal/kg?

A. 230.80 hrs
B. 280.54 hrs
C. 350.35 hrs
D. 300.54 hrs

The heating value of fuel supplied in a boiler is 40,000 kj/kg. if the factor of evaporation is 1.10 and the actual specific evaporation is 10, what is the efficiency of the boiler?

A. 62.70%
B. 53.08 %
C. 78.05 %
D. 54.97 %

What is the rate of evaporation of a water tube boiler if the factor of evaporation is 1.10, percent rating of 100% and the heating surface area is 250 m^2?

A. 7,816.16 kg/hr
B. 7,898.67 kg/hr
C. 6,789.45 kg/hr
D. 5,768.54 kg/hr

Steam is admitted to the cylinder of an engine in such a manner the average pressure is 120 psi. the diameter of the piston is 10 in. and the length of stroke is 12 in. what is the Hp of the engine when it is making 300 rpm?

A. 171.4 Hp
B. 175 Hp
C. 173.2 Hp
D. 174.4 Hp

Steam enters the turbine stage with an enthalpy of 3628 Kj/kg at 70 m/s and leaves the same stage with an enthalpy of 2846 kj/kg and a velocity of 125 m/s. calculate the power if there are 5kg/s steam admitted at the turbine throttle?

A. 4597.45 KW
B. 3976.55 KW
C. 3883.31 KW
D. 1675.42 KW

Steam with an enthalpy of 800 kCal/kg enters a nozzle with a velocity of 80m/s. Find the velocity of steam at the exit of the nozzle if its enthalpy is reduced to 750kCal/kg, assuming the nozzle is horizontal and disregarding heat losses. Take g=9.81 m/s^2 and constant J=427 kgm/kCal.

A. 452.37 m/s

B. 245.45 m/s

C. 651.92 m/s

D. 427.54 m/s

Steam is expanded through a nozzle of the enthalpy drop per kg of steam from the intial pressure to the final pressure is 60 kj. Neglecting friction, find the velocity of discharge and exit area of the nozzle to pass 0.20kg/s if the specific volume of the steam at exit is 1.5 m^3/kg.

A. 346.4 m/s, 879 m^2

B. 356.7 m/s, 278 m^2

C. 765.6 m/s, 467 m^2

D.346.4 m/s, 866 m^2

A 6MW steam turbine generator power plant has a full-load rate of 8 kg/kW-hr. Assuming that no load steam consumption as 15% of full-load steam consumption., compute the hourly steam consumption at 75% load in kg/hr.

A. 37,800 kg/hr

B. 38,700 kg/hr

C. 30,780 kg/hr

D. 30,870 kg/hr

A 4kg air enters a turbine with enthalpy of 600KJ and velocity of 250 m/s. The enthalpy at ecit is 486 KJ and velocity of 170m/s. What is the work developed if there is a heat loss of 10KJ?

A. 128.83 kJ

B. 171.2 kJ

C. 80.2 kJ

D. 28.3 kJ

Calculate drive horsepower for pumping 1703 L/min vold water to a tank suction at 127 mm Hg vacuum, delivery at 5.3 kg/cm^2 ga., both measured close to pump, e_p=0.65.

A. 31.42 HP

B. 20.42 HP

C. 35.42 HP

D. 23.02 HP

Find the length of a suspension bunker to contain 181 tons of coal without surcharge, width of 4.6 m; depth of 4.3 m. The level capacity of a suspension bunker is 5/8 wdL. Density of coal is 800 kg/m^3.

A. 18.30 m

B. 12.80 m

C. 17.61 m

D. 12.61 m

A 305 mm x 457 mm four single acting diesel is rated at 150 kW at 260 rpm. Fuel consumption is at rated load 0.26 kg/kW-hr with a heating value of 43,912 kJ/kg. Calculate the brake thermal efficiency.

A. 31.63%

B. 41.64%

C. 21.63%

D. 35.63%

The break thermal efficiency of a 1MW diesel electric plant is 35%. Find the heat generated by fuel in kW if generator efficiency is 89%.

A. 3121.10 kW

B. 3528.64 kW

C. 4121.10 kW

D. 4528.64 kW

In an air standard brayton cycle, the compressor receives air at 101.325 kPa, 21C and it leaves at 600kPa at the rate of 4kg/s. Det the turbine work if the temperature of the air entering the turbine is 1000C.

A. 3000 kW

B. 2701 kW

C. 2028 kW

D. 3500 kW

Kerosene is the fuel of gas turbine plant: fuel air ratio, m_f=0.012, T_3=972K, pressure ratio r_p=4.5, exhaust to atmosphere. Find the available energy in kJ/kg air flow. Assume k=1.34 and C_p=1.13.

A. 352.64 kJ/kg

B. 452.64 kJ/kg

C. 252.64 kJ/kg

D. 552.64 kJ/kg

An ideal gas turbine operates with a pressure ratio of 10 and the energy input in the high temperature heat exchanger is 300 kW. Calculate the air flow rate for a temperature limits of 30C and 1200C

A. 0.25 kg/s

B. 0.34 kg/s

C. 0.41 kg/s

D. 0.51 kg/s

In air standard brayton cycle, the inlet temperature and pressure are 20C and 101.325kPa. The turbine inlet condition is 1200 kPa and 900C. Det the air flow rate if the turbine produces 12 MW.

A. 21.41 kg/s

B. 20.20 kg/s

C. 19.25 kg/s

D. 18.10 kg/s

A gas turbine power plant operating on the brayton cycle delivers 15 MW to a standby electric generator. What is the mass flow rate and the volume flow rate of air if the minimum and maximum pressures are 100 kPa and 500 kPa respectively, and temperature of 20C and 1000C.

A. 31.97 kg/s, 26.88 m3/s

B. 36.98 kg/s, 28.99 m3/s

C. 41.97 kg/s, 26.88 m3/s

D. 46.98 kg/s 28.99 m3/s

IN a hydraulic plant, the difference in elevation between the surface of the water at intake and the tallrace is 650 ft when the flow is 90 cfs, the friction loss in the penstock is 65 ft and the head utilized by the turbine is 500 ft. The mechanical friction in the turbine 110 HP, and the leakage loss is 4cfs. Find the hydraulic efficiency.

A. 87.45 %

B. 84.57 %

C. 85.47 %

D. 78.54 %

Ahydro-electric power plant consumes 60,000,000 kW-hr/year. What is the net head if the expected flow is 1500 m3/min and over-all efficiency is 63%.

A. 34.34 m

B. 43.43 m

C. 44.33 m

D. 33.44 m

A pelton type turbine has a gross head of 40 m and a friction head loss of 6m. What is the penstock diameter if the penstock length is 90m and the coefficient of friction head loss is 0.001 (Morse).

A. 2040 mm

B. 3120 mm

C. 2440 mm

D. 2320 mm

The water velocity of a 5m x1m channel is 6m/s. What is the annual energy produced ifthe net head is 20m and the over-all efficiency is 80%?

A. 494,247,258 kW-hr

B. 247,497,502 kW-hr

C. 247,494,528 kW-hr

D. 472,497,582 kW-hr

Hydro-electric impulse turbine is directly coupled to a 24 pole, 60Hz alternator. It has a specific speed of 60 rpm and develops 3000 Hp. What is the required diamtere assuming a peripheral speed ratio of 0.45.

A. 0.661 m

B. 0.552 m

C. 0.443 m

D. 0.775 m

In a hydro-electric power plant the tailwater elevation is at 500m. What is the head water elevation if the head is 30m and the head loss is 5% of the gross head?

A. 785.25 m

B. 582.57 m

C.528.57m

D. 758.25m

The tailwater and the head water of a hydro-electric plant are 150m and 200m respectively. What is the power if the flow is 15m3/ and a head loss of 10% of the gross head?

A. 6621.75 kW

B. 621.65 kW

C.5621.76 kW

D. 4621.56 kW

In a hydro-electric plant, water flows at 10m/s in a penstock of 1m^3 cross-sectional area. If the net head of the plant is 30m and the turbine efficiency is 85%, what is the turbine output?

A. 2501.55 kW

B. 2100.21 kW

C. 3626.34 kW

D. 3124.65 kW

A 75 MW power plant has an average load of 35000kW and load factor of 65%. Find reserve over peak.

A. 21.15 MW

B. 23.41 MW

C. 25.38MW

D. 18.75 MW

A power plant is said to have/had a use factor of 48.5% and a capacity factor of 42.4%. How many hours did it operate during the year?

A. 6600.32 hrs

B. 7658.23 hrs

C. 8600.32 hrs

D. 5658.23 hrs

A 50000kWsteam plant delivers an annual output of 238,000,000 kW-hr with a peak load of 42,860 kW. What is the annual load factor and capacity factor?

A. 0.634, 0.534

B. 0.643, 0.534

C. 0.634, 0.543

D. 0.643, 0.534

Calculate the use factor of a power plant if the capacity factor is 35% and it operates 8000hrs during the year?

A. 38.325 %

B. 38.825 %

C. 35.823 %

D. 32.538 %

If the air required for combustion is 20kg/kg of coal and the boiler uses 3000kg of coal/hr, determine the mass gas entering the chimney. Assume an ash loss of 15%.

A. 40,644 kg/hr

B. 70,200 kg/hr

C. 62,550 kg/hr

D. 50,500 kg/hr

A 15kg gas enters a chimney at 10m/s. If the temperature and pressure of gas are 26C and 100kPa respectively, what is the diameter of chimney? R=0.287 kJ/kg-K.

A. 1.57m

B. 2.6m

C. 2.22m

D.1.28m

A two-stage air compressor at 90kPa and 20C discharges at 700kPa. Find the polytropic exponent if the intercooler intake temperature is 100C.

A. 1.29

B. 1.33

C. 1.4

D 1.25

A two-stage compressor receives 0.35 kg/s of air at 100kPa and 269K and delivers it at 5000kPa. Find the heat transferred in the intercooler.

A. 70.49 kW

B. 80.49 kW

C. 90.49 kW

D. 100.49 kW

A centrifugal pump is charged 20 L/s against a head of 17m when the speed is 1500 rpm. The diameter of the impeller was 30cm and the brake HP was 6.0. A geometrically similar pump 40cm in diameter is to run at 1750rpm. Assuming equal efficiencies, what BP is required?

A. 51.55 HP

B. 50.15 HP

C. 40.14 HP

D. 45.15 HP

A pump delivers a 20cfm of water having a density of 62 lb/ft3. The suction and discharge gage read 5 inHg of vacuum and 30psi respectively. The discharge gage is 5 ft above the suction gage. If pump efficiency is 70%, what is the motor power?

A. 5.31 HP

B. 3.31 HP

C. 4.31 HP

D. 6.31 HP

Calculate the air power of a fan that delivers $1200m^3/min$ of air through a 1m x 1.5m outlet. Static pressure is 120mm WG and density of air is 1.18.

A. 20.45 HP

B. 25.64 HP

C. 30.45 HP

D. 35.64 HP

Determine the temperature for which a thermometer with degrees F is numerically twice the reading of the temperature in degrees C.

A. -24.6
B. 320
C. 160
D. -12.3

During takeoff in a spaceship, an astronaut is subjected to acceleration equal to 5 times the pull of the earth's std.gravity. If the astronaut is 180 lb and takeoff vertical, what force does he exert on the seat?

A. 4810.9 N

B. 4415.9 N

C. 8829 N

D. 9620 N

A pressure cooker operates by cooking food at a higher pressure and temperature than is possible at atmospheric conditions. Steam is contained in the sealed pot, with vent hole in the middle of the cover, following the steam to escape. The pressure is regulated by covering the vent hole with a small weight, which is placed slightly by escaping steam. The pressure is regulated by covering the vent hole with a small weight, which is displaced slightly by escaping steam. Atmospheric pressure is 100kPa, the vent hole area is $7 mm^2$ and the pressure inside should be 250kPa. What is the mass of the weight?

A 0.107 kg

B. 1.05 kg

C. 1.75 kg

D. 0.1783 kg

A barometer can be used to measure an airplane's altitude by comparing the barometric pressure at a given flying altitude to that on the ground. Determine an airplane's altitude if the pilot measures the barometric pressure at 700 mmHg, the ground reports it at 758 mmHg and the average density is 1.19 kg/m^3. $G=9.8m/s^2$.

A. 987 m

B. 633 m

C. 788 m

D. 663 m

A mixture of 0.4lbm of helium and 0.2 lbm of oxygen is compressed polytropically from 14.7psi and 60F to 60 psia according to n=1.4. Determine the final temperature.

A. 727.7 R

B. 777.2 R

C. 722.7 R

D. 277.7 R

A mixture of 0.4lbm of helium and 0.2 lbm of oxygen is compressed polytropically from 14.7psi and 60F to 60 psia according to n=1. Determine the Polytropic work.

A. 139 BTU

B. 239 BTU

C. 339 BTU

D. 539 BTU

A pump in a municipality's water supply system receives water from the filtration beds and pumps it up to the top of the water tower. The tower's height is 35m, inlet piping of 2m below the pump's intake. Temperature of water at 20C, measured at the bottom of the inlet and discharge from the pump. The mass flow rate through the pump is 100kg/s, diameter of the inlet piping is 25cm and the diameter of the discharge piping is 15cm. Determine the power required by the system.

A. 77.3 KW

B. 33.77 KW

C. 34.42 KW

D. 42.34 KW

An adiabatic tank containing air used to power an air during times of peak power demand. The tank has a volume of 500m3 and contains air at 1000 kPa and 500K. Determine the mass remaining when the pressure reaches 100kPa.

A. 276.37 kg

B. 672.73 kg

C. 772.73 kg

D. 227.73 kg

Determine the air fuel ratio on a molar basis for the complete combustion of octane with theoretical amount of air.
(No given choices)

Answer:

A. 59.5 kgair/kgfuel

During a steady state operation, a gearbox receives 60kW through the input shaft and delivers power through the output shaft. For the gear box as the system, the rate of energy transfer is by convection. h=0.171 kW/m^2K is the heat transfer coefficient, A=1m2 is the outer surface area of the gear box, T_h=300K (27C) is the temperature and the outer surface, T_f=293K (20C) is the temperature of the surroundings away from the immediate vicinity if the gear box. Determine the power delivered to the output shaft in kW if the heat transfer rate is 1.2 kW.

A. 98.8 KW

B. 78.8 KW

C. 68.8 KW

D. 58.8 KW

A single acting air compressor with clearance of 6% takes in air atmospheric pressure at a temperature of 85F and discharged pressure of 85 psia. The air handled is 0.25 ft^3/cycle measured at discharged pressure. If the compression is isentropic, find the piston displacement per cycle if the compressor is running at 750 rpm.

A. 0.0750 ft^3/cycle

B. 0.025 ft^3/cycle

C. 1.030 ft^3/cycle

D. 1.090 ft^3/cycle

A single acting air compressor with clearance of 6% takes in air atmospheric pressure at a temperature of 85F and discharged pressure of 85 psia. The air handled is 0.25 ft^3/cycle measured at discharged pressure. If the compression is isentropic, find the air HP of the compressor if rpm is 750.

A. 16 HP

B. 96 HP

C. 69 HP

D. 61 HP

A nozzle receives 0.5 ks/s of air pressure of 2700 kPa and a velocity of 30 m/s and enthalpy of 923 kJ/kg and the air leaves at a pressure of 700 kPa and with enthalpy of 660 kJ/kg. Determine the exit velocity from the nozzle.

A. 923 m/s

B. 726 m/s

C. 700 m/s

D. 660 m/s

A 2-stage double-acting compressor is to deliver 90 lb/min of air from 14.3 psia and 90F to a final pressure of 185 psia. The normal barometer is 29.8 in-Hg and the temperature is 80F. The pressure drop in the inter cooler is 3psia and the speed is 210 rpm and $pV^{1.34}=C$ during compression and expansion. The clearance is 5% for both cylinders. The temperature of the cooling water increased by 18F. Find the volume of free air.

A. 1282 CFM

B. 1230 CFM

C. 1320 CFM

D. 1822 CFM

Consider 4800 lb of steam per hour flowing through a pipe at 100 psia pressure. Ssume a velocity of 5280 ft/min. What size of pipe is required? Specific volume of steam at 100 psia v=4.432 ft^3/lb.

A. 3 in

B. 5 in

C. 4 in

D. 6 in

A boiler plant generates 224,000 lb of steam and burns 13.9 tons of coal per hour. The coal has a heating value of 11400 BTU/lb. A test of a particulates leaving the boiler shows that 3804 lb of particulate is being discharged per hour. What is the particulate discharged per million BTU heat input to the furnace?

A. 12 lb/10^6 BTU

B. 14 lb/10^6 BTU

C. 15 lb/10^6 BTU

D. 16 lb/10^6 BTU

A turbine receives 150 lbm/sec of air 63 psia and 2450R and expands it polytropically to 14.7 psia. The exponent "n" is equal to 1.45 for the process. Determine the power.

A. 52,343.16 BTU/sec

B. 53,343.16 kW

C. 53,343.16 HP

D. 53,343.16 ft-lb/sec

Find the thrust and efficiency of two 2-m diameter propellers through which flows a total of 600m3/s of air 11.3 N/m3. The propellers are attached to an airplane moving at 250 kph through still air. Neglect eddy losses.

A. 36,077 N, 73%

B. 77,630 N, 37%

C. 66,033 N, 33%

D. 77,330 N, 77%

A liquid with a specific gravity of 1.26 is being pumped in a pipeline from A to B. At A, the pipe diameter is 60 cm and the pressure is 300 kN/m^2. At B, the pipe diameter is 30cm, and the pressure is 330 kN/m^2. Point B is 1.0m lower than A. Find the flow rate if the pump puts 16kW into the flow. Neglect head loss.

A. 4.2 m^3/s

B. 0.42 m^3/s

C. 2.4 m^3/s

D. 0.24 m^3/s

A reciprocating compressor handles 1,400 cfm of air measures at intake where p1=18 psia ant T1=90F.The discharged pressure is 92 psia. Calculate the work if the process of the compression is isothermal.

A. -180.5 HP

B. -179.5 HP

C. -227.6 HP

D. -228.6 HP

The fuel has the following analysis: C=89%, N_2=2%, H_2=8%, S=1% with excess air, what is the actual amount air needed to burn the fuel oil?

A. 13.17 kgair/kgfuel

B. 13.47 kgair/kgfuel

C. 14.47 kgair/kgfuel

D. 14.17 kgair/kgfuel

A pump discharges 550 gpm of water to a height of 35 ft. With an efficiency of 80%. What is the power input?

A. 6.09 HP

B. 6.32 HP

C. 4.74 HP

D. 4.94 HP

A room contains air at 20C and 96 kPA at a relative humidity of 75%. Determine the enthalpy of moist air.

A. 45.919 KJ/kgda

B. 45.515 KJ/kgda

C. 49.515 KJ/kgda

D. 41.815 KJ/kgda

A piston moves inside a cylinder at a velocity of 6.0m/s. The 160mm diameter piston is currently located within the 160.2mm inside diameter cylinder. The film of oil is separating the piston from the cylinder has an absolute viscosity of 0.4 N-s/m2. Assuming a linear velocity profile, find the shear stresses in the oil. (T= μV/H).

A. 50,000 N/m2

B. 40,000 N/m2

C. 24,000 N/m2

D.34,000 N/m2

If the speed is to be increased to 1200 rpm, determine the impeller diameter that should be used so that the same shaft input power would be required.

A. 5.32 ft

B. 2.35 ft

C. 5.23 ft

D. 2.93 ft

Determine the mass of water vapour contained in a 150m3 room at 100 kPa, 23C and 40% relative humidity. From steam tables: Psat @ 23C=2.810 kPA.

A. 1.6342 kg

B. 1.9342 kg

C. 1.2342 kg

D. 2.2342 kg

What is the power of the pump, HP, if it delivers 925 gal/min of water against a head of 15m?

A. P=15.38 HP

B. P=16.38 HP

C. P=10.5 HP

D. 11.5 HP

Kerosene is pumped into an aircraft fuel tank through a hose that has an inside diameter of 4cm. If the velocity of a kerosene is 8 m/s through the hose, determine the mass flow rate. Assume that kerosene has a density of 800 kg/m3.

A. 7.06 kg/m3

B. 7.56 kg/m3

C. 8.06 kg/m3

D. 8.56 kg/m3

During the working stroke of an engine the heat transferred out of the system was 150 KJ/kg of working substance. The internal energy also decreased by 400 kJ/kg of working substance. Determine the work done.

A. 250 kJ/kg

B. 550 kJ/kg

C. 600 kJ/kg

D. 350 kJ/kg

During an experiment on Charles Law, the volume of gas trapped in the apparatus was 10000mm3 when the temperature was 18C. The temperature of the gas was then raised to 85C. Determine the new volume of gas trapped in the apparatus if the pressure exerted on the gas remained constant.

A. 12302.41 mm3

B. 8128.49 mm3

C. 70833.33mm3

D. 2117.64mm3

Find the density of oil with a specific gravity of 1.6 in g/cm3.

A. 15.68 g/cm3

B. 99 g/cm3

C. 0.8 g/cm3

D. 1.6 g/cm3

What is the absolute pressure if the gauge pressure is reading 9 bar and the atmospheric pressure is 0.9 bar?

A. 6.3 bar

B. 7.8 bar

C. 9.9 bar

D. 8.1 bar

The tank of an air compressor has a volume of 3ft3 and is filled with air at a temperature of 40F. If a gage on the tank reads 150 psig, what is the mass of the air in the tank?

A. 1.78 lbs

B. 2.00 lbs

C. 2.67 lbs

D. 1.98 lbs

What is the mass of acetylene gas, V=0.94 ft3, R=59.35 ftlb/lbR, T=90F, P=200psi.

A. 0.816 lb

B. 0.841 lb

C. 0.829 lb

D. 0.852 lb

Specific volume is the number of cubic meters of mixture per kilogram of dry air. If dry air has these following properties: Ra=287 J/kgK, T=303K, Pa=99.604 kPa. Solve for specific volume.

A. 0.873 m3/kg

B. 0.853 m3/kg

C. 0.953 m3/kg

D. 0.783 m3/kg

A refrigerating system operates on the reversed carnot cycle.The higher temperature of the refrigerant in the system is 120F and the lower is 10F. The capacity is 20 tons. Neglect losses. Determine the coefficient of performance.

A. 2.732

B. 5.373

C. 7.372

D. 4.273

At a pressure of 60F, a motor bike ire is inflated to 33psi. As it is driven along the C-5 road, the temperature rise to 76F. Assuming the volume remains constant. Determine the final pressure.

A. 34.47 psi

B. 49.17 psi

C. 35.00 psi

D.34.30 psi

Steam enters a turbine stage with an enthalpy of 3700 KJ/kg and a velocity of 80 m/s and leaves with an enthalpy of 2864 KJ/kg with a velocity of 128 m/s. If the rate of a steam flow through the turbine is 0.44 kg/s, what is the work done in KW?

A. 365 kW

B. 365.64 kW

C. 366 kW

D. 366.50 kW

Aluminum has a specific heat of 0.902 j/gC. How much heat is lost when a piece of aluminium with a mass of 23.984g cools from a temperature of 415C to a temperature of 22C?

A. 8500 J
B. 6000 J
C. 80,000 J
D. 7500K

If the temperature of an air parcel is 20.5C, and its density is 0.690 kg/m3, what is the pressure of the air parcel?

A. 40 kPa
B. 50 kPa
C. 60 kPa
D. 70 kPa

35 mL sample of gas is enclosed in a flask at 22C. If the flask was placed in an ice bath at 0 deg Celcius, what would the new gas volume be if the pressure is held constant?

A. 1 mL

B. 32.1 mL

C. 32.39 mL

D. 33.1 mL

A car engine with a power output of 65 HP has a thermal efficiency of 14%. Determine the fuel consumption of this car if the fuel HV of 19000 BTU/lbm.

A. 36.28 lb/hr
B. 37.28 lb/hr
C. 37.28 lb/hr
D. 35.30 lb/hr

The thermal eff of a carnot cycle operating between 170C and 620C is closest to:

A. 44%

B. 50%

C. 63%

D. 73%

Compute the humidity ratio of air at 70% relative humidity and 25C when the barometric pressure is 101.325 pa. From steam tables: Psat at 34C=3.168 kPa.

A. 0.014 kg water vapour/kg da

B. 0.14 kg water vapour/kg da

C. 1.4 kg water vapour/kg da

D. 0.0014 kg water vapour/kg da

A pressure gage registers 50 psi in a region where the barometer reads 14.8 psi. Find the absolute pressure in kPa.

A. 666.66 kPa

B. 556.66 kPa

C. 446.66 kPa

D. 336.6 kPa

Consider 1kg of air at 32C that expanded by a reversible polytropic process with n=1.23 until the pressure is lived. Determine the heat transfer if the Sp.heat at constant volume of air is 0.1786 kJ/kgK.

A. 17.02 kJ heat rejected

B. 7.05 kJ heat rejected

C. 17.02 kJ heat added

D. 7.05 kJ heat added

A motorcycle uses nitrogen (k=1.399) as the working substance. The heat supplied is 54 kJ and the adiabatic expansion ratio is 10. Determine the heat rejected.

A. 10 kJ

B. 32.4 kJ

C. 21.6 kJ

D. 54 kJ

A tank contains 20 kg of air at 200 kPa (gage) and 23C. During heating g process the temperature of air rises. For safety purposes a technician installed a relief-cycle type valve so that pressure of air inside the tank never exceed 260 kPa (gage). At wht air temperature the relief valve will start releasing air?

A. 112 C

B. 92 C

C. 82 C

D. 102 C

An air compressor takes in 9 kg/min of air at 98 kPa, V1=0.125 m3/kg and discharges it at 680 kPa, V2=0.03 m3/kg. The increase of internal energy is 93 kJ/kg and the work done on air is 163 kJ/kg; the change in potential and kinetic energy are neglected. How much heat is transferred per kg of air?

A. 264.15 kJ/kg

B. 61.85 kJ/kg

C. 288.65 kJ/kg

D. 78.15 kJ/kg

During a reversible process there are abstracted 317 kJ/s from 1.134 kg/s from 1.134 kg/s of a certain gas while the temperature remains constant at 26.7C. For this gas Co=2.232 and Cv=1.713 kJ/kgK. The initial pressure is 586 kPa. Determine the final volume flow rate.

A. 0.301 m3/s

B. 0.03 m3/s

C. 0.5 m3/s

D. 0.05 m3/s

Flow of water in a pipe has a velocity at 10m/s. Determine the velocity head of the water.

A. 50.1 m

B. 5.10 m

C. 8.20 m

D. 100m

A diesel cycle has a cut-off ratio of 2.20 and a compression ratio of 1.0. Find cycle efficiency.

A. 55.1 %

B. 59.735%

C. 52.23 %

D. 62.37 %

A diesel cycle has an initial temperature of 27C. If the cut-off ratio is 2.50 and compression ratio is 12. Find the maximum cycle temperature.

A. 1634.4 C

B. 1753.44 C

C. 2010.3 C

D. 1983.4 C

A diesel engine which takes in air at 1 bar, 26C has a compression ratio of 19. Determine the operating clearance in percent.

A. 8.08

B. 8.56

C. 7.52

D. 5.55

Otto Cycle has an initial pressure of 100 kPa and has a pressure of 400 kPa after adiabatic compression. Find cycle efficiency.

A. 32.70%

B. 34.70%

C. 36.70%

D. 38.70%

Otto cycle has a clearance of 8% and heat added of 1000 kJ. Find the heat rejected.

- A. 364 KJ
- B. 353 KJ
- C. 709 KJ
- D. 867 KJ

An otto cycle has a heat rejected 300 kJ and work of 700 kJ. Find the cycle efficiency.

A. 56%

B. 60%

C. 70%

D. 50%

An otto cycle has a pressure ratio of 7. What is the cycle compression ratio?

A. 5.18
B. 6.34
C. 7.34
D. 4.01

Find the power a rotating shaft which develops a torque of 188 Nm at 1350 rpm.

A. 101.54 HP

B. 53.63 HP

C. 63.35 HP

D. 35.63 HP

Determine the pressure exerted on a diver at 30m below the free surface of the sea. Assume a barometric pressure of 101 kPa and specific gravity of sea water is 1.03.

A. 404 kPa

B. 410 kPa

C. 420 kPa

D. 430 kPa

An air compressor has an inlet enthalpy of 35 BTU/lb and an exit enthalpy of 70 BTU/lb. The mass flow rate of air is 3 lb/s. If the heat loss is 466.62 BTU/min, find the work input to the compressor.

A. 139.59 HP

B. 149.59 HP

C. 159.59 HP

D. 169.59 HP

An automobile vacuum gauge reads 600 mmHg when the barometer reads 760 mmHg. What is the absolute condenser pressure in bar?

A. 0.0213

B. 0.061

C. 0.213

D. 0.610

Water flows in a pipe at the rate of 10 kg/s. If the velocity of the flow is 10 m/s, find the pipe diameter

A. 30.23 mm

B. 35.68 mm

C. 38.39 mm

D. 42.39 mm

What is the resulting pressure when one kg of air at 104 kPa and 98C is heated at constant volume to 450C?

A. 202.67 kPa

B. 194.67 kPa

C. 186.53 kPa

D. 198.65 kPa

Determine the degrees of superheat of steam at 101.325 kPa and 170C.

A. 50 C
B. 70 C
C. 60 C
D. 80 C

Calculate approximate enthalpy of water at 90C.

- A. 366.83 kJ/kg
- B. 376.83 kJ/kg
- C. 386.83 kJ/kg
- D. 396.83 kJ/kg

A carnot cycle operates between 30C and 350C. Find the cycle efficiency.

A. 51.36%

B. 63.45%

C. 45.37%

D. 76.45%

A carnot cycle has a temperature of 550F and minimum temperature of 100F. If the heat added is 4200 BTU/min, find HP output of the engine.

A. 34.53

B. 40.56

C. 44.13

D. 65.40

A carnot cycle has a sink temperature of 100F and cycle eff of 70%. Find the temperature of the heat source.

A. 1306.70F

B. 1406.70F

C. 1506.70F

D. 1606.70F

The quality of steam is 20%. This means that:
(No given answer; page 92)

A. Mass of liquid is 20%, mass vapour is 80%

B. Mass of liquid is 100%, mass of vapour is 0%

C. Mass of liquid is 80%, mass of vapour is 20%

D. None of the above

50 kg of cooling water per second enter the condenser at 25C and leaves at 50C. Find the heat carried away by water.

A. 1234.45 kW

B.5233.75 kW

C. 2340.53 kW

D. 3140.25 kW

10 kg/s of steam enter the turbine with an enthalpy of 3200 kJ/kg and enter the condenser with an enthalpy of 2500 kJ/kg in a rankine cycle. If the turbine eff is 80% and the generator eff is 90%, determine the power plant output.

A. 4320 kW

B. 3213 kW

C. 4056 kW

D. 5040 kW

Determine the quality of steam in a vessel containing 2 kg of saturated vapour and 8 kg of saturated liquid.

A. 100%

B. 20%

C. 80%

D. 60%

The condenser of a reheat power plant rejects heat at the rate of 600 kW. The mass flow rate of cooling water is 5 kg/s and the inlet cooling water temperature is 35C. Calculate the condenser cooling water exit.

- A. 43.45 C
- B. 53.45 C
- C. 63.66 C
- D. 74.34 C

A heat engine has a thermal efficiency of 50%. How much power does the engine produce when heat is transferred at a rate of 10^9 kj/hr?

A. 50 MW

B. 75 MW

C. 138 MW

D. 147 MW

1 kg of air is compressed adiabatically and in a steady flow manner. The compression eff is 80% and the work done on the air is 265 kJ/kg. Compute the heat.

- A. 212 kJ/kg
- B. 100 kJ/kg
- C. 0 kJ/kg
- D. 331.25 kJ/kg

A 300 kJ of heat flows by conduction from the outside to the inside of a cold storage in one hour. If the temperature and all other conditions are the same, what is the heat flowing through the cold storage room in two hours?

A. 600 kJ

B. 900 kJ

C. 300 kJ

D. 1200 kJ

Determine the sp.heat weight of air at 760 mmHg absolute and 22C?

A. 1.014 kg/m3

B. 1.316 kg/m3

C. 1.197 kg/m3

D. 1.266 kg/m3

A refrigerant machine that is classified as a one-ton machine has the capacity to produce a cooling effect of:

A. 3.517 kW

B. 12,000 BTU/hr

C. 211 kJ/min

D. All of the above