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Courses » RAC Product Design

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Unit 3 - WEEK 1

Course outline

How to access the portal

Pre-requisite ASSIGNMENT

WEEK 1

Introduction to Product Design

Design Considerations

Psychrometry and Air Conditioning Calculations

Refrigerants

Quiz : Assignment1

WEEK 2

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WEEK 4

Solution of Assignment Problems

Assignment1

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment. **Due on 2018-09-05, 23:59 IST.**

This assignment is based on the basic concepts of product design, refrigeration cycle, psychrometry, air-conditioning calculations, refrigerants nomenclature and selection.

Note: Assignment requires the use of steam tables and psychrometric chart.

1) Which among the following is the suggested sequence for the Design process: **1 point**

- Problem definition, recognition of need, synthesis, analysis & optimisation, reliability testing & risk analysis, stakeholder alignment, product launch.
- Problem definition, synthesis, recognition of need, analysis & optimisation, stakeholder alignment, reliability testing & risk analysis, product launch.
- Problem definition, reliability testing & risk analysis, synthesis, recognition of need, analysis & optimisation, stakeholder alignment, product launch.
- Recognition of need, Problem definition, synthesis, analysis & optimisation, reliability testing & risk analysis, stakeholder alignment, product launch.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Recognition of need, Problem definition, synthesis, analysis & optimisation, reliability testing & risk analysis, stakeholder alignment, product launch.

2) Select the refrigerant(s) which is/are azeotropic mixtures: **1 point**

- R410A
- NH3
- R22

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Score: 0**Accepted Answers:**

R410A

R502

3) Select the following, which would increase the COP of the refrigeration cycle: **1 point**

- Use of condenser that incorporates a water injection system.
- Liquid subcooling after condensation.
- Using a large-sized compressor instead of the existing one.
- Superheating of refrigerant vapours prior to compression.
- Compressing the refrigerant vapours to higher pressures.
- Over-charging the system.
- Under-charging the system.
- Insulating a hermetically sealed compressor.

No, the answer is incorrect.**Score: 0****Accepted Answers:***Use of condenser that incorporates a water injection system.**Liquid subcooling after condensation.*4) Which of the following are valid in conjunction to a design problem? **1 point**

- There is exactly one optimum solution and one must strive to achieve it.
- There may be many feasible options, one can choose based on past experiences and future risks.
- There are no single correct answers to a design problem.
- Infeasible designs must be explored first.

No, the answer is incorrect.**Score: 0****Accepted Answers:***There may be many feasible options, one can choose based on past experiences and future risks.**There are no single correct answers to a design problem.*5) On a psychrometric chart (at 1 atm Pressure), the constant WBT lines coincide with **1 point**

- isenthalpic curves
- RH curves
- isochoric curves
- isothermal DBT curves
- RSHF curves
- none of the above

No, the answer is incorrect.**Score: 0****Accepted Answers:***none of the above*6) To achieve the same comfort condition, the coil ADP for a hot and humid location as compared to that of a hot and dry location is likely to be **1 point**

- Higher

- Lower
 Same
 Can be higher or lower
 Insufficient information in the question

No, the answer is incorrect.

Score: 0

Accepted Answers:

Lower

7) Consider a standard vapor compression refrigeration cycle. Consider two scenarios, in the **2 points** first the condenser temp is decreased by ΔT and in the second, evaporator temp is increased by the same ΔT , then which among the following(s) would be true?

- Carnot COP would have a greater enhancement with decrease in T_{cond}
 Carnot COP would have a greater enhancement with increase in T_{evap}
 Cooling capacity would have a greater enhancement with decrease in T_{cond}
 Cooling capacity would have a greater enhancement with increase in T_{evap}

No, the answer is incorrect.

Score: 0

Accepted Answers:

Carnot COP would have a greater enhancement with increase in T_{evap}

Cooling capacity would have a greater enhancement with increase in T_{evap}

8) Pick up the WRONG statement(s). A refrigerant should have

0 points

- Low liquid specific heat
 Low viscosity
 High boiling point
 High critical temp
 Low latent heat of vaporization

No, the answer is incorrect.

Score: 0

Accepted Answers:

Low viscosity

High boiling point

Low latent heat of vaporization

9) At a higher altitude in Ladakh region, the barometric air pressure was measured to be **4 points** 65kPa, The dew point and specific humidity ranges of air at 25° DBT and 40%RH, are _____°C and _____ g/kg.

- DPT between 10-11 and w between 7-8
 DPT between 10-11 and w between 12-13
 DPT between 16-17 and w between 7-8
 DPT between 16-17 and w between 12-13

No, the answer is incorrect.

Score: 0

Accepted Answers:

DPT between 10-11 and w between 12-13

10) For a counter flow cooling tower, water enters at 34°C and leaves at 21°C. Air enters from the

bottom of the tower at 20°C and 60%RH. Determine the enthalpy potential for total heat transfer (in kJ/kg) at the bottom of the cooling tower.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 18 , 19

2 points

11) On a psychrometric chart, a positive RSHF could mean

3 points

- negative sensible heat and negative latent heat
- negative sensible heat and positive latent heat
- positive sensible heat and positive latent heat
- positive sensible heat and negative latent heat

No, the answer is incorrect.

Score: 0

Accepted Answers:

negative sensible heat and negative latent heat

negative sensible heat and positive latent heat

positive sensible heat and positive latent heat

positive sensible heat and negative latent heat

12) Select the option(s) which are TRUE

3 points

- In a direct evaporative cooling process, the WBT remains constant even if Lewis Ratio is not equal to 1.
- The superheating of refrigerant within the evaporator always increases the COP of a Vapour Compression System.
- The range of RSHF is from $(-)\infty$ to $(+)\infty$
- Water at 20°C is sprayed in an airstream at 25°C, 50% RH. In the process, air gets cooled and water gets heated.
- The GSHF line is the same as the coil condition curve.

No, the answer is incorrect.

Score: 0

Accepted Answers:

The range of RSHF is from $(-)\infty$ to $(+)\infty$

The GSHF line is the same as the coil condition curve.

13) Dew point temperature of given moist air at atmospheric pressure is the

3 points

- temperature of air when cooled with vapour pressure remaining same until moisture starts to condense
- temperature of air when cooled adiabatically until moisture starts to condense
- temperature of air when it has 100%RH at the same humidity ratio
- temperature of air when it has 100%RH at the same WBT
- Saturation temperature of water at the partial pressure of water vapor in air
- Temperature of air after throttling to a lower pressure.

No, the answer is incorrect.

Score: 0

Accepted Answers:

temperature of air when cooled with vapour pressure remaining same until moisture starts to condense
temperature of air when it has 100%RH at the same humidity ratio
Saturation temperature of water at the partial pressure of water vapor in air

14) In the journey for design of new products to delivery of reliable products, which of the following(s) is essential? **3 points**

- The desire for innovation and creative expression.
- The spirit of adventure exploring unknown constraints.
- The ability to avoid risks and prevent failures.
- Gaining Management confidence to continue investing resources for further product development.
- Full comprehension of the design changes by staff/ management at all levels

No, the answer is incorrect.

Score: 0

Accepted Answers:

The desire for innovation and creative expression.
The spirit of adventure exploring unknown constraints.
The ability to avoid risks and prevent failures.
Gaining Management confidence to continue investing resources for further product development.

15) Steam at 100°C is blown into an air stream at 21°C DBT, 50% RH at the rate of 1kgsteam/150kg dry air. Determine the RH (%) of the exit air rounding off to the nearest integer value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 85,90

5 points

16) Saturated air at atmospheric pressure and temp of 30°C undergoes reversible adiabatic expansion to a pressure of 60 kPa. The final RH (in %) of air would be _____. (round off to the nearest integer value) **5 points**

- 0
- 10
- 50
- 100

No, the answer is incorrect.

Score: 0

Accepted Answers:

100

17) A refrigeration technician mistakenly charged R-12 into a refrigeration cycle in place of R-22 i.e. R22 compressor is now made to operate on R12. Assume that the cycle operates on simple VCC with condensing temp of 40°C & evaporating temp of (-)5°C .What would be the case if the technician charged R-134a? **6 points**
 Select the correct option(s):

- The cooling capacity falls substantially for both cases, approximately by 40%.
- The cooling capacity increases for both cases, approximately by 40%.
- The cooling capacity falls in case of R12, approximately by 40% and increases in case of

R134a, approximately by 40%.

- The cooling capacity falls in case of R134a, approximately by 40% and increases in case of R12, approximately by 40%.
- The cooling capacity increases for both cases, approximately by 50%.
- The cooling capacity falls substantially for both cases, approximately by 50%.

No, the answer is incorrect.

Score: 0

Accepted Answers:

The cooling capacity falls substantially for both cases, approximately by 40%.

18000m³/min of conditioned air at 25°C DBT and 60%RH is mixed with 10m³/min of outside air at 35°C DBT and 30 %RH. The mixed stream is cooled in an AC unit from which discharges air at 15°C and 45%RH. Determine the cooling capacity of the A/C unit (in TR) rounding off to the nearest integer value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 30,35

6 points

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