

From the quantitative point of view, the most abundant component of air is

Select one:

- ☐ a. Oxygen
- ☐ b. Carbon dioxide
- ☐ c. Nitrogen
- ☐ d. No answer

Question 2

Not answered

Marked out of 2.00

v1 (latest)

Catalysts are used because

Select one:

- ☐ a. they shift equilibrium of chemical reactions
- ☐ b. they inhibit competitive unwanted reactions
- ☐ c. No answer
- ☐ d. they make a wanted reaction faster

Question 3

Not answered

Marked out of 2.00

v1 (latest)**Which of the following is a correct statement of Gauss' law?**

Select one:

- ☐ a. no answer
- ☐ b. The flux of the electric displacement field (**D**) through any surface (closed or not) is zero.
- ☐ c. The flux of the electric displacement field (**D**) through any closed surface is equal to the net electric charge enclosed within the surface.
- ☐ d. The flux of the electric displacement field (**D**) through any closed surface is zero.

Question 4

Not answered

Marked out of 2.00

v1 (latest)

The correct transformation of the complex formulation of the voltage to the time dependent formulation is:

Select one:

- ☐ a.
- ☐ b.
- ☐ c.
- ☐ d. No answer

Question 5

Not answered

Marked out of 2.00

v1 (latest)

The current through an inductor with inductance L changes from 0 to I during a given time interval $[t_0, t_1]$. The resulting variation in the energy U stored in the inductor is:

Select one:

- ☐ a. no answer
- ☐ b. $\Delta U = LI$
- ☐ c. It is impossible to answer without knowing the behavior of the voltage as a function of time during the interval $[t_0, t_1]$.
- ☐ d. $\Delta U = \frac{1}{2} LI^2$

Question 6

Not answered

Marked out of 2.00

v1 (latest)

Two resistors, whose resistances are equal to $10\ \Omega$ and $20\ \Omega$, are connected in parallel. Their equivalent resistance is approximately:

Select one:

- ☐ a. $6.7\ \Omega$
- ☐ b. no answer
- ☐ c. $10\ \Omega$
- ☐ d. $30\ \Omega$

Question 7

Not answered

Marked out of 2.00

v1 (latest)

What is the definition of impedance?

Select one:

- ☐ a. No answer
- ☐ b. the ratio between the voltage phasor and the current phasor once the user conventions have been chosen
- ☐ c. the complex number that represents the resistance of a bipole powered at a sinusoidal regime
- ☐ d. the resistance offered by a load to the passage of current

Question 8

Not answered

Marked out of 2.00

v1 (latest)

The equivalent resistance of the following circuit is:

Select one:

- ☐ a. $R_{AB}=10.14 \Omega$
- ☐ b. No answer
- ☐ c. $R_{AB}=5.27 \Omega$
- ☐ d. $R_{AB}=4.17 \Omega$

Question 9

Not answered

Marked out of 2.00

v1 (latest)

What are the correct dimensions in SI of specific enthalpy and specific entropy (for unit mass)?

Select one:

- ☐ a. no answer
- ☐ b. $\left[\frac{J}{m^3} \right]$ $\left[\frac{J}{m^3 K} \right]$
- ☐ c. $\left[\frac{J}{m K} \right]$ $\left[\frac{J}{kg} \right]$
- ☐ d. $\left[\frac{J}{kg} \right]$ $\left[\frac{J}{kg K} \right]$

Question 10

Not answered

Marked out of 2.00

v1 (latest)

Which are the thermodynamic processes in a Carnot cycle?

Select one:

- ☐ a. no answer
- ☐ b. 1 isobaric process, 1 isothermal process, 2 isentropic processes
- ☐ c. 2 isobaric processes, 2 isentropic processes
- ☐ d. 2 isothermal processes, 2 isentropic processes

Question 11

Not answered

Marked out of 2.00

v1 (latest)

Which are the main dimensionless numbers in convection?

Select one:

- ☐ a. No answer
- ☐ b. $Nu = \frac{hL}{k} \quad Re = \frac{wL}{\nu} \quad Pr = \frac{a}{\nu} \quad Gr = \frac{\beta g \cdot \Delta T \cdot L}{\nu^2}$
- ☐ c. $Nu = \frac{hL}{k} \quad Re = \frac{wL}{\nu} \quad Pr = \frac{\nu}{a} \quad Gr = \frac{\Delta T \cdot L^3}{\beta g \cdot \nu^2}$
- ☐ d. $Nu = \frac{hL}{k} \quad Re = \frac{wL}{\nu} \quad Pr = \frac{\nu}{a} \quad Gr = \frac{\beta g \cdot \Delta T \cdot L^3}{\nu^2}$

Question 12

Not answered

Marked out of 2.00

v1 (latest)

How to evaluate the net heat transfer rate by thermal radiation between two black surfaces?

Select one:

- ☐ a. $\dot{Q}_{12} = F_{12} A_1 \sigma (T_1^4 - T_2^4) \quad [\text{W}]$
- ☐ b. $\dot{Q}_{12} = \sigma (T_1^4 - T_2^4) \quad [\text{W}]$
- ☐ c. $\dot{Q}_{12} = F_{12} A_1 \sigma (T_1 - T_2) \quad [\text{W}]$
- ☐ d. No answer

Question 13

Not answered

Marked out of 2.00

v1 (latest)

Which is the correct definition of enthalpy?

Select one:

- ☐ a. No answer
- ☐ b. $dH = U + p \cdot v \quad [\text{J/kg}]$
- ☐ c. $dH = dU + p \cdot dv + v \cdot dp \quad [\text{J/kg}]$
- ☐ d. $dH = dU + p \cdot dv \quad [\text{J/kg}]$

Question 14

Not answered

Marked out of 2.00

v1 (latest)

Which is a correct formulation of the first law of thermodynamic?

Select one:

- ☐ a. $dQ - dL_e = dH + d\left(\frac{w^2}{2}\right) + g \cdot dz$
- ☐ b. No answer
- ☐ c. $Q - L_e = dH + d\left(\frac{w^2}{2}\right) + g \cdot dz$
- ☐ d. $dQ - dL + dH + d\left(\frac{w^2}{2}\right) + g \cdot dz = 0$

Question 15

Not answered

Marked out of 2.00

v1 (latest)

Which is the definition of specific heat capacity at constant pressure?

Select one:

- ☐ a. $c_p = \left(\frac{\partial Q}{\partial T} \right)_p \left[\frac{\text{J}}{\text{kg} \cdot \text{K}} \right]$
- ☐ b. $c_p = \left(\frac{\partial U}{\partial T} \right)_p \left[\frac{\text{J}}{\text{kg} \cdot \text{K}} \right]$
- ☐ c. No answer
- ☐ d. $c_p = \left(\frac{\partial H}{\partial T} \right)_p \left[\frac{\text{J}}{\text{kg} \cdot \text{K}} \right]$

Question 16

Not answered

Marked out of 2.00

v1 (latest)

What is the correct formulation of the log mean temperature difference?

Select one:

- ☐ a. $\Delta T_{\ln} = \frac{\Delta T_1 - \Delta T_2}{\Delta T_1 / \Delta T_2}$
- ☐ b. $\Delta T_{\ln} = \frac{\ln(\Delta T_1 / \Delta T_2)}{\Delta T_1 - \Delta T_2}$
- ☐ c. no answer
- ☐ d. $\Delta T_{\ln} = \frac{\Delta T_1 - \Delta T_2}{\ln(\Delta T_1 / \Delta T_2)}$

Question 17

Not answered

Marked out of 2.00

v1 (latest)

What is the COP (Coefficient of Performance) of an ideal Carnot heat pump working between the temperatures $T_{\text{hot}} = 40^{\circ}\text{C}$ and $T_{\text{cold}} = 5^{\circ}\text{C}$?

Select one:

- ☐ a. $COP_{\text{heat pump}} = 8.94$
- ☐ b. $COP_{\text{heat pump}} = 1.14$
- ☐ c. $COP_{\text{heat pump}} = 7.94$
- ☐ d. no answer

Question 18

Not answered

Marked out of 2.00

v1 (latest)

The daily energy consumption of an electrical water heater rated 2.5kW and working 3 hours per day is:

Select one:

- ☐ a. 7.5 kWh
- ☐ b. 7.5 MJ
- ☐ c. 7.5 kW
- ☐ d. No answer

Question 19

Not answered

Marked out of 2.00

v1 (latest)

How to evaluate the specific enthalpy of moist air?

Select one:

- ☐ a. $h' = 1.0 \cdot T [^{\circ}\text{C}] + y \cdot (2500 + 1.9 \cdot T [^{\circ}\text{C}]) \left[\frac{\text{J}}{\text{kg}_{\text{da}}} \right]$
- ☐ b. No answer
- ☐ c. $h' = 1.0 \cdot T [\text{K}] + y \cdot (2500 + 1.9 \cdot T [\text{K}]) \left[\frac{\text{J}}{\text{kg}_{\text{da}}} \right]$
- ☐ d. $h' = 1.0 \cdot T [^{\circ}\text{C}] + y \cdot (2500 + 1.9 \cdot T [^{\circ}\text{C}]) [\text{J}]$

Question 20

Not answered

Marked out of 2.00

v1 (latest)

How to evaluate the entropy changes for ideal gases? (p is the pressure, T is the absolute temperature, c_p is the specific heat capacity at constant pressure, R_1 is the gas constant)

Select one:

- ☐ a. $dS = c_p \frac{dT}{T} - R_1 \frac{dp}{p}$
- ☐ b. $dS = c_p \frac{dT}{T} + R_1 \frac{dp}{p}$
- ☐ c. $dS = c_v \frac{dT}{T} + R_1 \frac{dp}{p}$
- ☐ d. No answer

Question 21

Not answered

Marked out of 2.00

v1 (latest)

The boundary layer is:

Select one:

- ☐ a. a thin flow layer close to wall
- ☐ b. where only heat transfer can occur
- ☐ c. No answer
- ☐ d. a boundary condition for inviscid flows

Question 22

Not answered

Marked out of 2.00

v1 (latest)

A correct form of the Rankine – Hugoniot equation could be:

Select one:

- ☐ a. no answer
- ☐ b. $\frac{dA}{A} + (1 - Ma^2) \frac{dp}{p} = 0$
- ☐ c. $\frac{dA}{A} + (1 - Ma^2) \frac{dp}{\rho} = 0$
- ☐ d. $\frac{dA}{A} + (1 - Ma^2) \frac{dv}{v} = 0$

Question 23

Not answered

Marked out of 2.00

v1 (latest)

Among the following, which is the correct form of the ideal gas equation of state (p: pressure; ρ : density; v: specific volume; R: specific constant of gas; T: temperature; g: gravitational acceleration)?

Select one:

- ☐ a. no answer
- ☐ b. $\frac{P}{V} = RT$
- ☐ c. $\frac{P}{\rho} = RT$
- ☐ d. $pv = gRT$

Question 24

Not answered

Marked out of 2.00

v1 (latest)

Considering the compressor of a turbogas working under the conditions in the brackets (mass flow rate: 50 kg/s, inlet enthalpy: 300 kJ/kg, outlet enthalpy: 500 kJ/kg), which power value is it consuming?

Select one:

- ☐ a. No answer
- ☐ b. -10 MW
- ☐ c. 10 kW
- ☐ d. -10 kW

Question 25

Not answered

Marked out of 2.00

v1 (latest)

The fundamental components of a turbomachinery stage are:

Select one:

- ☐ a. Rotor and stator
- ☐ b. No answer
- ☐ c. Hub and shroud
- ☐ d. Inducer and exducer

Question 26

Not answered

Marked out of 2.00

v1 (latest)

Why in spark-ignition engines it is not possible to increase the compression ratio as in Diesel engines?

Select one:

- ☐ a. No answer
- ☐ b. Because it is necessary to avoid auto-ignition before the spark activation
- ☐ c. Because it is a not efficient solution
- ☐ d. Because the spark plug cannot work at high pressure conditions

Question 27

Not answered

Marked out of 2.00

v1 (latest)

Which is the air (gas constant $R=287 \text{ J/(kgK)}$) density value at 1.013 bar and $T=300^\circ\text{C}$?

Select one:

- ☐ a. 0.01 g/m^3
- ☐ b. 1.18 kg/m^3
- ☐ c. 0.62 kg/m^3
- ☐ d. No answer

Question 28

Not answered

Marked out of 2.00

v1 (latest)

A ship propeller is:

Select one:

- ☐ a. similar to an axial pump rotor
- ☐ b. No answer
- ☐ c. a radial turbomachinery
- ☐ d. similar to an axial turbine rotor

Question 29

Not answered

Marked out of 2.00

v1 (latest)

Considering the turbine of a turbogas working under the conditions in the brackets (mass flow rate: 150 kg/s, inlet enthalpy: 1000 kJ/kg, outlet enthalpy: 550 kJ/kg), which power value is it generating?

Select one:

- ☐ a. 67.5 MW
- ☐ b. No answer
- ☐ c. 67.5 kW
- ☐ d. -20 MW

Question 30

Not answered

Marked out of 2.00

v1 (latest)

Considering an axial turbine working under the conditions in the brackets (mass flow rate: 100 kg/s, inlet enthalpy: 1000 kJ/kg, outlet enthalpy: 500 kJ/kg), which power value is it producing?

Select one:

- ☐ a. 500 kW
- ☐ b. 50 kW
- ☐ c. no answer
- ☐ d. 50 MW