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UPPSC-2021

UTTAR PRADESH

PUBLIC SERVICE COMMISSION 2021

Assistant Engineer

Mechanical Engineering

PAPER-I

Exam held on 29-05-2022

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Questions and Answer Keys

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UPPSC - 2021

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Q.1 निम्नलिखित में से तद्भव शब्द हैं
(a) मयंक (b) संतान
(c) वानर (d) धूलि

Ans. (a)

Q.2 'समाज' शब्द में कौन–सा प्रत्यय जोड़कर 'सामाजिक' शब्द बना है?
(a) ईय (b) इत
(c) ई (d) इक

Ans. (d)

Q.3 इनमें से 'मोर' का पर्यायवाची शब्द है
(a) अरुणशिखा (b) वारक
(c) ताम्रचूड़ (d) कलापी

Ans. (d)

Q.4 निम्नलिखित वर्गों में 'चन्द्रमा' के सभी पर्यायवाची शब्द किस वर्ग में शुद्ध हैं?
(a) हिमांशु, सुधांशु, सुधाकर
(b) चाँद, हिमांशु, अर्कजा
(c) चाँद, हिमांशु, पारावार
(d) चाँद, हिमांशु, पद्माकर

Ans. (a)

Q.5 'वह कौन–सा मनुष्य है, जिसने महाप्रतापी भोज का नाम न सुना हो' – यह वाक्य है
(a) समानाधिकरण वाक्य
(b) साधारण वाक्य
(c) मिश्र वाक्य
(d) संयुक्त वाक्य

Ans. (c)

Q.6 एक शब्द में महाप्राण व्यंजनों का प्रयोग नहीं हुआ है
(a) जोगन (b) घाघ
(c) झूठ (d) खीझ

Ans. (a)

Q.7 'पर्वत के ऊपर की समतल भूमि' के लिए एक शब्द है
(a) उपत्यका (b) पहाड़
(c) अधित्यका (d) पठार

Ans. (c)

Q.8 'पाण्डव' शब्द में इनमें से प्रयुक्त प्रत्यय है
(a) अव (b) व
(c) अ (d) इनमें से कोई नहीं

Ans. (c)

Q.9 इनमें से तत्सम और तद्भव का एक युग्म गलत है
(a) प्रिय – प्रिया (b) चुल्लिः –चूल्हा
(c) शक्तु – सत्तू (d) खर्पर – खपरा

Ans. (a)

Q.10 निम्मलिखित में से शुद्ध वर्तनी वाला शब्द है
(a) अनुग्रहित (b) अनग्रहीत
(c) अग्रहित (d) अनुगृहीत

Ans. (d)

Q.11 अधोलिखित शब्द – युग्मों में से कौन–सा शुद्ध है?
(a) पति – पत्नी (b) पति – पत्नि
(c) पती – पतनी (d) पती – पत्नी

Ans. (a)

Q.12 अनेकार्थी शब्द 'अक्षर' का इनमें से एक अर्थ नहीं है
(a) अंक (b) वर्ण
(c) मोक्ष (d) अविनाशी

Ans. (a)

Q.13 किस वर्ग की सभी ध्वनियाँ मूर्धन्य हैं?

(a) ट्, ठ्, ड्, ढ्, ष्

(b) क्, च्, ट्, त्, प्

(c) ट्, ठ्, ड्, श्, स्

(d) ख्, छ्, ठ्, थ्, फ्

Ans. (a)

Q.14 अर्थ और प्रयोग की दृष्टि से एक मुहावरा गलत है

(a) खाक छानना– दर–दर भटकना।
प्रयोग– राम ने पहले तो पढ़ाई नहीं की, अब नौकरी के लिए खाक छान रहा है।

(b) आस्तीन का साँप – धोखबाज
प्रयोग– मैं जिसे अपना मित्र समझता था, वह आस्तीन का साँप निकला।

(c) ओखली में सिर देना – जान–बूझकर विपत्ति में फँसना।
प्रयोग– उसे कितना समझाया था कि रामसेवक के साथ मिलकर खेती मत करो लेकिन वह माना ही नहीं। उसने जान–बूझकर ओखली में सिर दे ही दिया।

(d) हाथ मलना – हाथ साफ करना।
प्रयोग– कड़ाके की सर्दी में वह अपने हाथ मल रहा था।

Ans. (d)

Q.15 किस वाक्य में सकर्मक क्रिया है?

(a) श्याम खाता है।

(b) साँप सरकता है।

(c) सूरज निकलता है।

(d) गाय बैठती है।

Ans. (c)

Q.16 'साझे की हाँड़ी चौराहे फूटी' कहावत का अर्थ है

(a) भ्रमण पर जाने से कार्य बिगड़ जाता है।

(b) जिम्मेदारी एक व्यक्ति की हो, अन्यथा कार्य बिगड़ जाता है।

(c) सावधानी से कार्य करना।

(d) सभी बिना जवाबदेही के कार्य करें तो सफलता हाथ लगती है।

Ans. (b)

Q.17 'अश्व' का पर्यायवाची शब्द नहीं है

(a) वाजि (b) सैंधव

(c) वैशाखनन्दन (d) हय

Ans. (c)

Q.18 'वह (व्यक्ति) जिसने संन्यास ग्रहण किया हो' – इस वाक्यांश के लिए एक शब्द है

(a) प्रव्राज (b) प्रवजित

(c) प्रव्रजित (d) प्रशमित

Ans. (c)

Q.19 निम्नांकित शब्द – युग्मों में से विलोम शब्दों की दृष्टि से एक युग्म गलत है, वह है

(a) हयादार – बेहया

(b) अभिमानी – निरभिमान

(c) अज्ञ – अनभिज्ञ

(d) सुशासन – कुशासन

Ans. (c)

Q.20 निम्नलिखित में से वर्तनी की दृष्टि से कौन–सा शब्द सही नहीं है?

(a) प्रातिनिधिक (b) आधीन

(c) आध्यात्मिक (d) आभ्यन्तरिक

Ans. (b)

Q.21 इनमें से 'अग्नि' का पर्यायवाची शब्द नहीं है

(a) जातवेद (b) वैश्वानर

(c) कान्तार (d) शाण्डिल्य

Ans. (c)

Q.22 निम्नलिखित में से एक का अर्थ 'पाँवों की आहट' भी है

(a) शरासन (b) कमान

(c) धनुष (d) चाप

Ans. (a)

Q.23 निम्नलिखित शब्दों में से एक में उपसर्ग का प्रयोग नहीं है

(a) कुढंग (b) कुतरना
(c) कुठौर (d) कुर्तक

Ans. (b)

Q.24 निम्नलिखित में से कौन–सा विशेषण शब्द है?

(a) भालू (b) आलू
(c) ढालू (d) बालू

Ans. (c)

Q.25 अधोलिखित में से 'नदी' के पर्यायवाची किस वर्ग में नहीं है?

(a) तरंगिणी, सरिता
(b) निम्नगा, तरंगिणी
(c) आपगा, तटिनी
(d) जाह्नवी, यियामा

Ans. (d)

Q.26 In an axial turbine stage relative velocity at rotor inlet and outlet are 80 m/s and 150 m/s respectively. The mean rotor peripheral speed is 68.4 m/s, work output in the stage is 13500 J. What is the nearest value of degree of reaction?

(a) 0.8 (b) 0.9
(c) 0.6 (d) 0.7

Ans. (c)

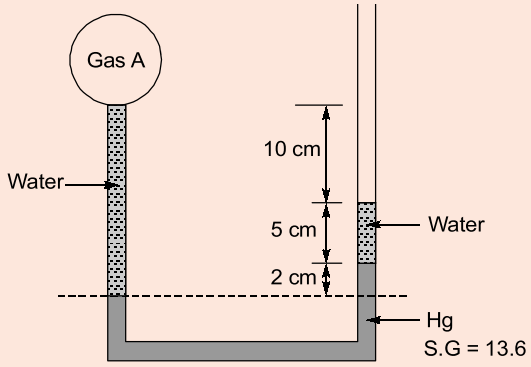
Q.27 The distance between centroid and centre of pressure of plane submerged in water at angle θ is [where the terms have their usual meaning]

(a) $\frac{I_0 \sin\theta}{Ah}$ (b) $\frac{I_0}{Ah}$

(c) $\frac{Ah\sin^2\theta}{I_0}$ (d) $\frac{I_0 \sin^2\theta}{Ah}$

Ans. (d)

Q.28 The absolute pressure of gas A in the bulb in 'mm of Hg' is



(a) 752.65 (b) 771.20
(c) 748.80 (d) 767.35

Ans. (b)

Q.29 The ideal gas equation PV = nRT is used to model a real gas. The modelling is more accurate when

(a) Pressure and molar mass are low but temperature is high,
(b) Pressure, temperature and molar mass are low.
(c) Pressure and molar mass are high but temperature is low.
(d) Pressure and temperature are high but molar mass is low.

Ans. (a)

Q.30 In Parson's reaction turbine, the relationship between angles of fixed blades and moving blades is

[Angle symbols have their usual meaning]

(a) $\alpha_1 = \beta_2$ (b) $\alpha_1 = \alpha_2$
(c) $\beta_1 = \beta_2$ (d) $\alpha_1 = \beta_1$

Ans. (a)

Q.31 In a cooling tower 'approach' is the temperature difference between

(a) Hot water inlet and WBT of air
(b) Hot water inlet and cold water outlet
(c) DBT and WBT of air
(d) Cold water outlet and WBT of air

Ans. (d)

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EC : 16th June, 2022	ME : 16th June, 2022
ME : 16th June, 2022	EE : 16th June, 2022
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Q.32 For a linear distribution of velocity profile in the laminar boundary layer on a flat plate given by $\frac{u}{U_\infty}=\frac{y}{\delta}$, the ratio of displacement thickness (δ^*) to the boundary layer thickness (δ) is

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$

(c) $\frac{1}{5}$ (d) $\frac{1}{2}$

Ans. (d)

Q.33 Mixture of water and steam (critical specific volume = 0.003155 m^3/kg) is kept in a rigid steel tank of volume of 0.025 m^3 at 0.1 MPa. The mass of mixture is 10 kg. If the tank is slowly heated the liquid level in the tank

(a) Will fall
(b) Will rise
(c) May rise or fall depending on the amount of heat transferred
(d) Will remain constant

Ans. (b)

Q.34 For maximum transmission of power through a pipeline with total head H, the head lost due to friction is given by

(a) $\frac{H}{3}$ (b) $0.1\,H$

(c) $\frac{2H}{3}$ (d) $\frac{H}{2}$

Ans. (a)

Q.35 In a Pelton wheel the bucket peripheral speed is 10 m/s, the water jet velocity is 25 m/s and volumetric flow rate is 0.1 m^3/s. If the jet deflection angle is 120° and flow is ideal the power developed is

(a) 15 kW (b) 7.5 kW
(c) 37.5 kW (d) 22.5 kW

Ans. (*)

Q.36 Choose the correct statement
The curve for unsteady state heating and cooling of bodies with Bi < 0.1 is

(a) Exponential curve and asymptotic to time axis.
(b) Parabolic curve and asymptotic to time axis.
(c) Hyperbolic curve and asymptotic to both time and temperature axis.
(d) Exponential curve and asymptotic to both time and temperature

Ans. (a)

Q.37 A mixture of two or more pure substances is

(a) A pure substance as long as the chemical composition of all phases is the same.
(b) Pure substance
(c) Not a pure substance
(d) None of the above

Ans. (a)

Q.38 A flat plate thickness 5 cm and thermal conductivity has 1 W/mK. The convection heat transfer coefficient on it's two faces are 10 W/m^2K and 20 W/m^2K. Its overall heat transfer coefficient in W/m^2K is

(a) 6.33 (b) 5
(c) 30 (d) 20

Ans. (b)

Q.39 In a simple impulse turbine, the nozzle angle at the entrance is 30°. For maximum diagram efficiency the blade speed ratio is

(a) 0.25 (b) 0.433
(c) 0.75 (d) 0.5

Ans. (b)

Q.40 For a fully developed flow of water in a pipe having diameter of 10 cm, velocity 0.1 m/s and kinematic viscosity 10^{-5} m^2/s, the value of Darcy's fraction factor is

(a) 0.016 (b) 0.008
(c) 0.064 (d) 0.032

Ans. (c)

Q.41 Dry flue gas with a composition of $CO_2 = 10.4\%$, $O_2 = 9.6\%$, $N_2 = 80\%$, indicate that
(a) Air is insufficient
(b) Excess air is used
(c) Air is just sufficient
(d) Hydrogen is not present in the coal

Ans. (b)

Q.42 Assuming isothermal condition and air to be an ideal gas, the variation in atmospheric pressure with height from the law of fluid statics is
(a) Exponential (b) Linear
(c) Cubic (d) Quadratic

Ans. (a)

Q.43 A 4-row velocity compounded steam turbine develops total power of 6400 kW. What is the power developed by the last row?
(a) 400 kW (b) 200 kW
(c) 1600 kW (d) 800 kW

Ans. (a)

Q.44 Identify the correct expression for Stanton number (St).
(a) Re.Pr (b) $\frac{Nu}{Re.Pr}$
(c) $\frac{Gr}{Re^2}$ (d) Gr.Pr

Ans. (b)

Q.45 Which of the following relations is valid only for a reversible processes undergone by a closed system?
(a) $Tds = dU + pdV$
(b) $\delta Q = dU + \delta W$
(c) $\delta Q = dU + pdV$
(d) $Tds = dU + \delta W$

Ans. (c)

Q.46 The delay period in a petrol engine is of the order of
(a) 0.002 sec (b) 0.001 sec
(c) 0.05 sec (d) 0.01 sec

Ans. (a)

Q.47 Heat is transferred by all the 3 modes, conduction, convection and radiation in
(a) Steam condenser
(b) Electric heater
(c) Refrigerator condenser
(d) Boiler

Ans. (d)

Q.48 The total heat load in an auditorium is 100 kW. If excess moisture generation rate is 60 kg/hr and air conditioner is supplying conditioned air (density = 0.85 m^3/kg) at a flow rate of 500 m^3/min, the sensible heat factor for auditorium is
(a) 0.4 (b) 0.272
(c) 0.959 (d) 0.738

Ans. (*)

Q.49 A small insulated steam whistle causes a drop of 0.8 kJ/kg in the enthalpy from inlet to exit. If inlet kinetic energy is negligible, the steam velocity at exit is
(a) 40 m/s (b) 4 m/s
(c) 120 m/s (d) 80 m/s

Ans. (a)

Q.50 The moderator used in a fast breeder reactor is
(a) Beryllium oxide
(b) Graphite
(c) Liquid sodium
(d) None of the above

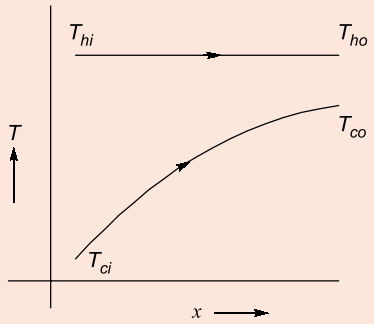
Ans. (d)

Q.51 The time constant of a thermocouple is the time taken
(a) To attain 99% of initial temperature difference
(b) To attain 50% of initial temperature difference

(c) To attain 63.2% of initial temperature difference
(d) None of the above

Ans. (c)

Q.52 The temperature distribution for a heat exchanger is shown in the figure. The type of heat exchanger is



(a) Counter flow (b) Parallel flow
(c) Condenser (d) Boiler

Ans. (c)

Q.53 For an engine working on standard Otto cycle, the clearance ratio is 0.1. The specific heat ratio of air is 1.4, the cycle efficiency is
(a) 39.8% (b) 38.3%
(c) 61.7% (d) 60.2%

Ans. (c)

Q.54 It is appropriate that area of cross-section for a fin be
(a) increased along the length
(b) reduced along the length
(c) maintained constant along the length
(d) none of the above is applicable

Ans. (b)

Q.55 In a fluid shear stress τ is $\mu\left(\frac{du}{dy}\right)^n$. If exponent $n > 1$, the fluid is
(a) Dilatantant fluid
(b) Bingham plastic
(c) Pseudo plastic fluid
(d) Newtonian fluid

Ans. (a)

Q.56 In vapour compression refrigeration system, the effect of liquid refrigerant undercooling is to
(a) increase COP
(b) reduce COP
(c) increase the vapour superheat
(d) reduce refrigerating effect

Ans. (a)

Q.57 Methane burns with stochiometric quantity air air. The air/fuel ratio by mass is
(a) 14.70 (b) 4
(c) 19.04 (d) 17.16

Ans. (d)

Q.58 The stagnation and static temperatures of flowing air at a section are 400 K and 200 K respectively. The Mach number is
(a) 1.246 (b) 1.046
(c) 3.211 (d) 2.236

Ans. (d)

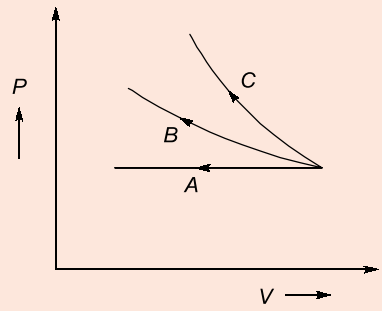
Q.59 For a room RTH = 100 kW, RSHF = 0.75, volume flow rate of air is 100 m^3/min and room humidity ratio = 0.01 kg/kg d.a. What is supply air humidity ratio (kg/kg)?
(a) 0.0075 (b) 0.010
(c) 0.0025 (d) 0.005

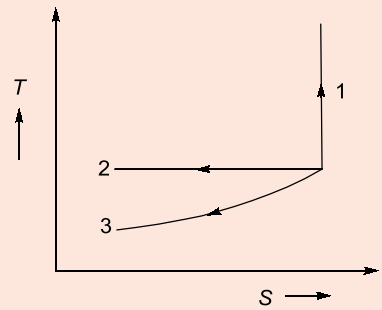
Ans. (d)

Q.60 A pump delivers 50 L/sec of water and consumes 7.5 kW of power. The head developed by the pump is
(a) 5.0 m (b) 7.5 m
(c) 15.32 m (d) 1.53 m

Ans. (c)

Q.61 Three processes are shown on P-V and T-S diagram. Match them and select the correct answer from codes given below





Codes:

	A	B	C
(a)	2	3	1
(b)	1	2	3
(c)	1	3	2
(d)	3	2	1

Ans. **(d)**

Q.62 In a laminar flow of Air (Pr = 0.7) flows over a heated plate. In the laminar flow if δ and δ_T are hydrodynamic and thermal boundary layer thicknesses respectively, then

(a) $\delta > \delta_T$
(b) $\delta = \delta_T$
(c) $\delta > 0$ but $\delta_T \neq 0$
(d) $\delta < \delta_T$

Ans. **(d)**

Q.63 For incompressible flow, a diverging section acts as a diffuser in the down stream for

(a) supersonic flows only
(b) subsonic flows only
(c) sonic state only
(d) both subsonic and supersonic flows

Ans. **(d)**

Q.64 Air at dry bulb temperature of 35°C and dew point temperature 20°C passes through a coil maintained at 25°C. The process undergone is

(a) sensible cooling
(b) cooling and dehumidification
(c) can not be inferred
(d) cooling and humidification

Ans. **(a)**

Q.65 The steady flow process work done is given by

(a) $\int_1^2 pdv$ (b) pv

(c) $\frac{p_1v_1 - p_2v_2}{n-1}$ (d) $-\int_1^2 vdp$

Ans. **(d)**

Q.66 The most significant advantage of using R-717 as refrigerant is

(a) high latent heat
(b) characteristic smell
(c) inflammability
(d) solubility in water

Ans. **(a)**

Q.67 Pressure drag results due to

(a) turbulence in the wake
(b) formation of wake
(c) high Reynold's number
(d) existence of stagnation point in front of a body

Ans. **(d)**

Q.68 A desert cooler having a cooling efficiency of 70% reduces the temperature of ambient air from 37°C to 30°C. The Wet Bulb Temperature (WBT) of air is

(a) 25°C (b) 24°C
(c) 27°C (d) 26°C

Ans. **(c)**

Q.69 In a wind turbine, if the velocity of wind is doubled, within the operating range, the power output will be
(a) Doubled
(b) Reduced to half
(c) Six times
(d) Eight times

Ans. (d)

Q.70 In a counter flow heat exchanger, hot gases enter at 250°C and leave at 100°C. Cooling air enters at 50°C and leaves at 80°C. The effectiveness of heat exchanger will be
(a) 0.25 (b) 0.2
(c) 0.75 (d) 0.33

Ans. (c)

Q.71 A Newtonian fluid has the following velocity field

$$\vec{v} = x^2y\vec{i} + 2xy^2z\vec{j} - yz^3\vec{k}$$

The rate of shear deformation at (–2, –1, 2) for the given flow is
(a) –2 (b) –6
(c) 4 (d) –12

Ans. (*)

Q.72 Water is used as a refrigerant in
(a) Steam jet refrigeration system
(b) Vapour compression refrigeration system
(c) NH_3–H_2O absorption refrigeration system
(d) None of the above

Ans. (a)

Q.73 For a given set of operating pressure limits of a Rankine cycle, the highest efficiency occurs in
(a) Superheated cycle
(b) Saturated cycle
(c) Regenerative cycle
(d) Reheat cycle

Ans. (d)

Q.74 The heat transfer equation $\nabla^2 T = 0$ is known as
(a) Fourier equation
(b) Laplace equation
(c) General heat conduction equation
(d) Poisson's equation

Ans. (b)

Q.75 A jet strikes a stationary plate normally with a velocity of 8 m/s and plate experiences a force of 120 N. The power obtained in kW is
(a) 7.68 (b) 0.96
(c) 960 (d) Zero

Ans. (d)

Q.76 An electric heater uses natural convection to heat water (K = 0.6 W/mK) using a rod of 1 cm diameter and 0.65 m length at 110 volt. The heater surface temperature is 120°C and water temperature is 35°C. If Nusselt number based on diameter is 6, current passing through the heater is
(a) 3.7A (b) 3.2 A
(c) 5.8 A (d) 4.6 A

Ans. (c)

Q.77 The temperature gradient in a flowing fluid over a flat plate is
(a) Zero at some location in the middle of boundary layer
(b) Zero at the surface
(c) Zero at the top of the boundary layer
(d) Remains constant

Ans. (c)

Q.78 Which of the following increase work ratio in a gas turbine?
1. Intercooling
2. Regeneration
3. Reheat

Select the correct answer:
(a) Only 1 and 2
(b) 1, 2 and 3

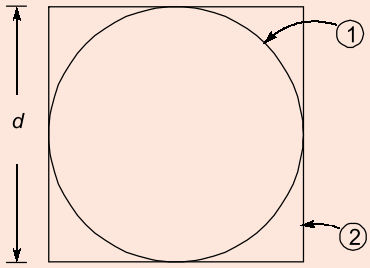
(c) Only 1 and 3
(d) Only 2 and 3

Ans. (c)

Q.79 The Normal Boiling Point (NBP) of ammonia is
(a) –29.7°C (b) –10.5°C
(c) –77.7°C (d) –33.3°C

Ans. (d)

Q.80 The shape factors F12 and F21, for the sphere of diameter 'd' and a cubical box of side 'd', as shown in figure, respectively are



(a) $\frac{\pi}{3}$ and 1 (b) 1 and $\frac{\pi}{3}$
(c) $\frac{\pi}{6}$ and 1 (d) 1 and $\frac{\pi}{6}$

Ans. (d)

Q.81 The velocity of steam at exit from the nozzle using motive steam for ejector is
(a) sonic
(b) subsonic
(c) may be subsonic or supersonic, any
(d) supersonic

Ans. (b)

Q.82 The average number of fast neutrons produced in the fission of an U-235 atom is nearly
(a) 2.46 (b) 1.23
(c) 4.92 (d) 3.69

Ans. (a)

Q.83 In a reversed Carnot cycle COP is 4. The ratio of highest and lowest temperature is
(a) 2 (b) 1.5
(c) 2.5 (d) 1.25

Ans. (d)

Q.84 If the back pressure of condensing steam turbine rises then the heat rate of steam turbine will
(a) Decrease
(b) Increase
(c) First increases upto a limit and then decreases
(d) Remains unaffected

Ans. (b)

Q.85 During adiabatic saturation process of unsaturated air the parameter remains constant is
(a) WBT (b) DBT
(c) RH (d) DPT

Ans. (a)

Q.86 32 kg of O_2 is mixed with 25 kg of N_2 at the same temperature. The gases are at the same pressure of 1 atm, before and after mixing. If R is universal gas constant in kJ/kmol.K, the change in entropy of the mixture is
(a) 0.693 R (b) 1.386 R
(c) 0.341 R (d) R

Ans. (b)

Q.87 The reciprocity theorem is
(a) $A_1F_{12} = A_2F_{21}$
(b) $F_{12} = F_{21}$
(c) $\epsilon_1 F_{12} = \epsilon_2 F_{21}$
(d) $A_2F_{12} = A_1F_{21}$

Ans. (a)

Q.88 A stream of moist air with DBT = 40°C and DPT = 25°C, passes through a water shower which is maintained at 20°C. The air stream will undergo a process of
(a) evaporative cooling
(b) sensible cooling
(c) cooling and dehumidification
(d) cooling and humidification

Ans. (c)

Q.89 In a flow between two stationary parallel plates, the shear stress is zero
(a) at the top
(b) at the centre where velocity is maximum
(c) both at the base and at the top
(d) at the base

Ans. (b)

Q.90 A gas is compressed in cylinder by a movable piston to half of its original volume. During the process 300 kJ heat left gas and internal energy remained the same.
The work done on the gas is
(a) 300 kJ (b) 150 kJ
(c) 214.3 kJ (d) 600 kJ

Ans. (a)

Q.91 Bell-Coleman cycle is
(a) Reversed Joule cycle
(b) Reversed Carnot cycle
(c) Reversed Rankine cycle
(d) Reversed Otto cycle

Ans. (a)

Q.92 **Assertion (A) :** In remote places the use of vapour absorption system is more advantageous than vapour compression system.
Reason (R) : The absorption system runs on relatively low temperature heat.
Select the correct answer from codes given below
Codes:
(a) Both A and R are correct but R is not a correct explanation of A
(b) Both A and R are correct and R is correct explanation of A
(c) A is false but R is true
(d) A is true but R is false

Ans. (d)

Q.93 A circular plate is submerged vertically in the water with greatest and least depth below the surface being 2.25 m and 0.75 m respectively. What is the total force in kN on one face of the plate?
(a) 16 (b) 12
(c) 26 (d) None of the above

Ans. (c)

Q.94 For a steady flow process, enthalpy changes from 400 kJ/kg to 100 kJ/kg and entropy changes from 1.1 kJ/kg.K to 0.7 kJ/kg.K. Ambient temperature is 300 K. Neglecting changes in kinetic and potential energies, the change in availability of the system is
(a) 300 kJ/kg (b) 420 kJ/kg
(c) 90 kJ/kg (d) 180 kJ/kg

Ans. (d)

Q.95 An ideal refrigerating machine works between 45°C and –8°C temperature limits. The power required per ton of refrigeration in kW is
(a) 1.2 (b) 1.0
(c) 0.7 (d) 0.8

Ans. (c)

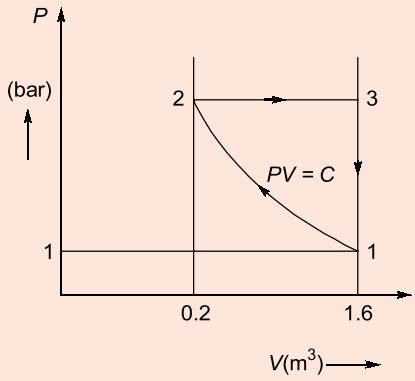
Q.96 If $\psi = 2xy$, the magnitude of resultant velocity at (2, –2) (in m/sec) is
(a) 4 (b) $4\sqrt{2}$
(c) $\sqrt{2}$ (d) –8

Ans. (b)

Q.97 COP of domestic air conditioner as compared of COP of domestic refrigerator is
(a) higher
(b) lower
(c) unpredictable
(d) same

Ans. (a)

Q.98 For the cycle shown in figure, if the change in internal energy $\Delta U_{3\text{-}1}$ is 3549 kJ. The work done in kJ in the process 2 - 3 is



(a) 1220 (b) 1120
(c) 1420 (d) 1340

Ans. (b)

Q.99 DBT and WBT both are 25°C and the air velocity is passing over human body is 6 m/min. If air velocity is increased to 20 m/min, the effective temperature (ET)
(a) increases
(b) decreases
(c) may increases or decreases depending on relative humidity
(d) remains constant

Ans. (d)

Q.100 A ship with hull length of 100 m is to run with a speed of 10 m/s. For dynamic similarity of a 1 : 25 model of the ship, the velocity in towing tank should be
(a) 10 m/s (b) 2 m/s
(c) 250 m/s (d) 50 m/s

Ans. (b)

Q.101 Which of the following is not true for an ideal refrigerant?
(a) critical pressure and temperature should be well above operating pressure and temperature limits.
(b) low latent heat of vaporization and high specific heat.
(c) high value of thermal conductivity.
(d) low value of specific volume.

Ans. (b)

Q.102 A gas having negative Joule-Thomson coefficient ($\mu < 0$), when throttled will
(a) Become warmer
(b) Become cooler
(c) Either be cooled or warmed, depends on type of gas
(d) Remain at the same temperature

Ans. (a)

Q.103 Which of the following increases during sensible heating of the moist air?
1. Relative humidity
2. Humidity ratio
3. Wet bulb temperature
4. Specific volume

Select the correct answer from codes given below
Codes:
(a) 3 only (b) 1 and 2
(c) 3 and 4 (d) 2 and 3

Ans. (c)

Q.104 In gas turbine, hot exhaust gases are used to heat the compressed air in a compact heat exchanger with effectiveness 0.8. What is the value of NTU?
(a) 4 (b) 2
(c) 16 (d) 8

Ans. (a)

Q.105 Two infinite parallel planes of same emissivity 0.5 each and exchanging heat by radiation. A radiation shield of emissivity 0.25, if placed between them, the heat transfer reduces by
(a) 25% (b) 50%
(c) 30% (d) 60%

Ans. (d)

Q.106 Which of the following can be considered a property of the system?

(a) $\int vdp$

(b) $\int pdV$

(c) $\int\left(\frac{dT}{T}-\frac{vdp}{T}\right)$

(d) $\int\left(\frac{dT}{T}+\frac{pdV}{V}\right)$

Ans. (c)

Q.107 The refrigerant which is the most miscible in oil is

(a) R-11 (b) R-717
(c) R-12 (d) R-22

Ans. (c)

Q.108 A two-dimensional flow field has velocity in x and y directions $u = x^2t$ and $v = -2xyt$ respectively, where t is time. The equation of stream line is

(a) xy^2 = constant
(b) x^2y = constant
(c) Not possible to determine
(d) xy = constant

Ans. (b)

Q.109 Two plates spaced 150 mm apart are maintained at 1000°C and 7°C are kept in stagnant air. The heat transfer between them is predominantly by

(a) free convection
(b) convection
(c) radiation
(d) forced convection

Ans. (c)

Q.110 A heat source at 900 K is brought in contact with ambient air at 300 K for a short time. During this process 9000 kJ heat is lost by heat source. The total availability loss in the process is

(a) 9000 kJ (b) 18000 kJ
(c) 6000 kJ (d) None of the above

Ans. (c)

Q.111 A pump raises pressure of a liquid from 1 bar to 30 bar. If the density of liquid is 990 kg/m^3 the isentropic work done in kJ/kg is

(a) 0.3 (b) 0.1
(c) 2.93 (d) 2.50

Ans. (c)

Q.112 The shear stress developed when lubricating oil of viscosity 9.81 poise is filled between two parallel plates 1 cm apart and moving with relative velocity 2 m/s is

(a) 196.2 Pa (b) 20 Pa
(c) 40 Pa (d) 29.62 Pa

Ans. (a)

Q.113 According to Blasius solution the local skin friction coefficient in the boundary layer over a flat plate is given by

(a) $\frac{0.664}{Re^{1/2}}$ (b) $\frac{0.332}{Re^{1/2}}$

(c) $\frac{1.328}{Re^{1/2}}$ (d) $\frac{0.664}{Re^{4/5}}$

Ans. (a)

Q.114 In which of the following processes there is an increase in entropy with no degradation of energy?

(a) Isochoric heat addition
(b) Polytropic expansion
(c) Isobaric heat addition
(d) Isothermal expansion

Ans. (d)

Q.115 The power required to drive a turbo-compressor for a given pressure ratio decreases when

(a) Air is cooled at entry
(b) Air is heated at entry
(c) Air is heated at exit
(d) Air is cooled at exit

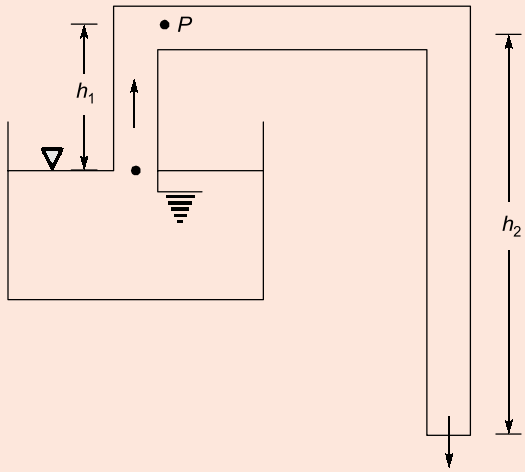
Ans. (*)

Q.116 For two cycles coupled in series, the topping cycle has an efficiency of 30% and the bottoming cycle has an efficiency of 20%. The overall combined cycle efficiency is

(a) 44% (b) 50%
(c) 55% (d) 38%

Ans. (a)

Q.117 An ideal fluid is discharging from a large reservoir as shown in figure. The velocity at location 'P' is



(a) $\sqrt{2gh_2}$ (b) $\sqrt{2gh_1}$

(c) $\sqrt{\frac{2g(h_1h_2)}{(h_1+h_2)}}$ (d) $\sqrt{2g(h_2-h_1)}$

Ans. (d)

Q.118 With increase in pressure, the enthalpy of dry saturated steam

(a) Decreases
(b) Increases
(c) First increases and then decreases
(d) Remains constant

Ans. (b)

Q.119 For an SI engine with increase in engine speed, torque

(a) Decreases
(b) Increases
(c) Remains constant
(d) First increases and then decreases

Ans. (d)

Q.120 The heat loss from a fin is 6 W. The effectiveness and efficiency of the fin are 3 and 0.75 respectively. The heat loss from the fin (in W) keeping the entire fin surface at base temperature, is

(a) 8 (b) 6
(c) 18 (d) 13.5

Ans. (a)

Q.121 The spark timing and combustion rate should be such that

(a) one half fo the pressure occurs at TDC
(b) peak pressure occurs at TDC
(c) ignition delay is reduced
(d) none of the above

Ans. (a)

Q.122 A rigid container of volume 0.5 m^3 contains 1 kg of water at 120°C

(at 120°C, $v_f = 0.00106\ m^3/kg$ and $v_f = 0.8908\ m^3/kg$)

The state of water is

(a) Saturated liquid
(b) Compressed liquid
(c) Superheated vapour
(d) A mixture of saturated liquid and saturated vapour

Ans. (d)

Q.123 Heat conduction in gases is due to

(a) Motion of electrons
(b) Electromagnetic waves
(c) Elastic impact of molecules
(d) Mixing motion of different layers of gases

Ans. (c)

Q.124 An engine operates at a fuel air ratio of 0.05, volumetric efficiency of 90% and indicated thermal efficiency of 30%. If density of air at intake is 1 kg/m^3 and fuel calorific value is 45 MJ/kg, the indicated mean effective pressure is

(a) 6.75 bar (b) 6.075 bar
(c) 243 bar (d) 67.5 bar

Ans. (b)

Q.125 Consider the following statement:
The erosion of steam turbine blades increase with the increase of
1. moisture of the steam
2. blade speed
Select the correct answer from options below:
(a) 2 alone true
(b) 1 alone true
(c) Neither 1 nor 2 are true
(d) Both 1 and 2 are true

Ans. (d)

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