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जब तक आपको यह परीक्षण पुस्तिका खोलने को न कहा जाए तब तक न खोलें।

सीरीज़

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Exam April-2016

प्रश्नों के उत्तर के लिये केवल काले बॉल-प्वाइंट पेन का प्रयोग करें।

अभ्यर्थी उत्तर-पत्रक पर उत्तर देने से पहले सभी अनुदेशों को सावधानीपूर्वक पढ़ लें।

आपको अपने सभी उत्तर केवल उत्तर-पत्रक पर ही देने हैं। परीक्षा के उपरांत उत्तर-पत्रक निरीक्षक को सौंप दें।

महत्त्वपूर्ण अनुदेश

- सभी प्रश्नों के उत्तर दें। सभी प्रश्नों के अंक समान हैं।
- उत्तर-पत्रक पर अभ्यर्थी अपना अनुक्रमांक, विषय, प्रश्न-पत्र का सही कोड एवं सीरीज़ अंकित करें अन्यथा उत्तर-पत्रक का मूल्यांकन नहीं किया जाएगा और उसकी जिम्मेदारी स्वयं अभ्यर्थी की होगी।
- इस परीक्षण पुस्तिका में 100 प्रश्न हैं। प्रत्येक प्रश्न के चार (4) वैकल्पिक उत्तर दिए गए हैं। अभ्यर्थी सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले अथवा बबल को उत्तर-पत्रक पर काले बॉल-प्वाइंट पेन से पूरा गहरा कर दें। एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा एवं उसे जाँचा नहीं जाएगा।
- अनुक्रमांक के अलावा परीक्षण पुस्तिका के कवर पेज पर कुछ न लिखें। इसके अलावा परीक्षण पुस्तिका के अन्दर और कुछ न लिखें। यदि आप रफ़ कार्य करना चाहते हैं, तो आप निरीक्षक से वर्किंग शीट माँग लें व इस पर वांछित सूचनाएँ भर लें।
- परीक्षण पुस्तिका खोलने के तुरन्त बाद जाँच करके देख लें कि परीक्षण पुस्तिका के सभी पेज भली-भाँति छपे हुए हैं। यदि परीक्षण पुस्तिका में कोई कमी हो, तो निरीक्षक को दिखाकर उसी सीरीज़ व कोड की दूसरी पुस्तिका प्राप्त कर लें।

जब तक आपको यह परीक्षण पुस्तिका खोलने को न कहा जाए तब तक न खोलें।

Note : English version of the instructions is printed on the back cover of this Booklet.

KNTCRA-58



MECHANICAL ENGINEERING – II

1. Water at 42 °C is sprayed into a stream of air at atmospheric pressure, dry bulb temperature of 40 °C and a wet bulb temperature of 20 °C. The air leaving the spray humidifier is not saturated. Which of the following statements is true ?
 - (a) Air gets cooled and humidified.
 - (b) Air gets heated and humidified.
 - (c) Air gets heated and dehumidified.
 - (d) Air gets cooled and dehumidified.

2. In an ideal vapour compression refrigeration cycle, the specific enthalpy of refrigerant (kJ/kg) at the following stages is given as
 Inlet of condenser = 283
 Outlet of condenser = 116
 Exit of evaporator = 232
 The CoP is
 - (a) 2.27
 - (b) 2.75
 - (c) 3.27
 - (d) 3.75

3. During the chemical dehumidification process of air
 - (a) dry bulb temperature and specific humidity decreases.
 - (b) dry bulb temperature increases and specific humidity decreases.
 - (c) dry bulb temperature decreases and specific humidity increases.
 - (d) dry bulb temperature and specific humidity increases.

4. Dew point temperature is the temperature at which condensation begins when the air is cooled at constant
 - (a) volume
 - (b) entropy
 - (c) pressure
 - (d) enthalpy

5. For air with a relative humidity of 80%
 - (a) the dry bulb temperature is less than the wet bulb temperature.
 - (b) the dew point temperature is less than the wet bulb temperature.
 - (c) the dew point and wet bulb temperatures are equal.
 - (d) the dry bulb and dew point temperatures are equal.

6. In window air-conditioner the expansion device used is
 - (a) capillary tube
 - (b) thermostatic expansion valve
 - (c) automatic expansion valve
 - (d) float valve

7. One ton of refrigeration is equivalent to SI unit of
 - (a) 1 kW
 - (b) 2.5 kW
 - (c) 3.5 kW
 - (d) 5 kW

8. Efficiency of a Carnot engine is 75%. If the cycle direction is reversed, CoP of the reversed Carnot cycle is
 - (a) 1.33
 - (b) 0.75
 - (c) 0.33
 - (d) 1.75

9. As an index of comfort, the temperature of saturated air at which a person would experience the same feeling of Comfort as experienced in the actual unsaturated environment is called
 - (a) Comfort temperature
 - (b) Effective temperature
 - (c) Wet bulb temperature
 - (d) Soothing temperature

10. If the specific humidity of moist air remains the same but its DBT increases, its DPT
- ~~(a) remains the same~~
(b) increases
(c) decreases
(d) may increase or decrease depending on its relative humidity.
11. In a vapour compression cycle, a good refrigerator should have a
- ~~(a) large latent heat of vaporization at condenser pressure.~~
(b) large latent heat at evaporator pressure.
(c) condenser pressure close to critical pressure.
(d) low critical pressure.
12. R-12 is preferred over R-22 in deep freezer, because
- (a) it has lower operating pressure.
(b) it gives higher CoP.
(c) it is miscible with oil over a large range of temperature.
~~(d) All of the above.~~
13. Low grade fuels have
- (a) low moisture content
(b) low ash content
~~(c) low calorific value~~
(d) high carbon content
14. Which of the following does not use ambient air for propulsion ?
- (a) Turbo jet (b) Pulse jet
(c) Turbo-prop (d) ~~Rocket~~
15. Humidity ratio can be given in terms of partial pressures of dry air (P_a) and water vapour (P_v) as
- (a) $0.622 \left(\frac{P_a}{P_v} \right)$
~~(b) $0.622 \left(\frac{P_v}{P_a} \right)$~~
~~(c) $0.622 \left(\frac{P_v}{P_v - P_a} \right)$~~
(d) None of the above
16. If the air is passed over the cooling coils then this process is termed as
- (a) sensible heating
~~(b) cooling with humidification~~
(c) cooling with dehumidification
(d) None of the above
17. CoP of air refrigerator is related with CoP of vapour compression refrigerator as
- (a) $(CoP)_{air} > (CoP)_{vap.c.}$
(b) $(CoP)_{air} < (CoP)_{vap.c.}$
~~(c) $(CoP)_{air} = (CoP)_{vap.c.}$~~
(d) None of the above
18. In an air craft refrigeration system the pressure at the cooling turbine outlet is equal to
- ~~(a) ambient pressure~~
(b) cabin pressure
(c) pressure at inlet to compressor
(d) None of the above
19. The relative humidity, during sensible heating
- (a) can increase or decrease
(b) increases
(c) decreases
~~(d) remains constant~~

20. Kelvin Planck law deals with
 (a) conversion of work into heat
 (b) ~~conversion of heat into work~~
 (c) conservation of work
 (d) conservation of heat

21. Thermodynamic work is the product of
 (a) Two intensive properties
 (b) Two extensive properties
 (c) ~~An intensive property and change in an extensive property~~
 (d) An extensive property and change in an intensive property

22. Air is compressed adiabatically in a steady flow process with negligible change in potential and kinetic energy. The work done in the process is given by

(a) ~~$-\int pdv$~~ (b) $+\int pdv$

(c) ~~$-\int vdp$~~ (d) $+\int vdp$

23. A heat engine is supplied with 250 kJ/s of heat at constant fluid temperature of 227 °C. The heat is rejected at 27 °C. The cycle is reversible, if the amount of heat rejected is
 (a) 273 kJ/s (b) 200 kJ/s
 (c) ~~180 kJ/s~~ (d) 150 kJ/s

24. The sequence of processes that eventually returns the working substance to its original state is known as
 (a) Event
 (b) Process
 (c) Thermodynamic property
 (d) ~~Thermodynamic cycle~~

25. If the dryness fraction of a sample by throttling calorimeter is 0.8 and that by separating calorimeter is also 0.8, then the actual dryness fraction of sample will be taken as

- (a) 0.8 (b) $\sqrt{0.8}$
 (c) ~~0.64~~ (d) ~~0.5~~

26. Thermodynamic equilibrium is completely defined by the specifications of

- (a) Internal energy
 (b) Enthalpy
 (c) Generalized displacements
 (d) ~~All of the above~~

27. Gas expands for a definite volume in a closed vessel. The maximum work will be done when the process is at constant

- (a) Volume
 (b) Temperature
 (c) ~~Pressure~~
 (d) Enthalpy

28. Which conversion is incorrect ?

- (a) 1 kWh = 3.6×10^6 Nm
 (b) 1 Nm = 0.238×10^{-3} kcal
 (c) 1 HP hr = 0.746 kWh
 (d) ~~1 kcal = 4.1868 Nm~~

29. In an air standard Diesel cycle at fixed compression ratio and fixed value of adiabatic index (γ)
- thermal efficiency increases with increase in heat addition cut-off ratio.
 - thermal efficiency decreases with increase in heat addition cut-off ratio.
 - thermal efficiency remains same with increase in heat addition cut-off ratio.
 - None of the above.
30. In Rankine cycle, the work output from the turbine is given by
- change in internal energy between inlet and outlet.
 - change in enthalpy between inlet and outlet.
 - change in entropy between inlet and outlet.
 - change of temperature between inlet and outlet.
31. For a closed system, undergoing an expansion process according to the law $PV^n = \text{constant}$, the work output.
- increases with increase in 'n'
 - increases with decrease in 'n'
 - is maximum when $n = 0$
 - is independent of 'n'
32. Law of degradation of energy says that unavailable energy is gradually decreasing due to
- increase in reversible processes.
 - increase in irreversible processes.
 - increase in unavailable energy.
 - None of these
33. For the same compression ratio, the efficiency of Brayton cycle is
- equal to that of Diesel cycle
 - equal to that of Otto cycle
 - equal to that of Dual cycle
 - greater than that of Diesel cycle
34. If the temperature at the turbine inlet is kept constant, the net output of a simple gas turbine plant would
- increase with increasing pressure ratio.
 - decrease with increasing pressure ratio.
 - first increase and then decrease with increasing pressure ratio.
 - remains unaffected with changes in pressure ratio.
35. When the relationship between Reynolds number and the friction factor is represented by a straight line, the flow is said to be
- isentropic
 - laminar
 - turbulent
 - vortex
36. At the point of separation
- velocity is maximum.
 - shear stress is zero.
 - shear stress is maximum.
 - pressure gradient is zero.

37. A potential function exists for
 (a) steady flow only
 (b) two dimensional irrotational flow only.
 (c) irrotational flow of fluid whether compressible or incompressible.
~~(d) irrotational flow of incompressible fluids only.~~
38. Which property of mercury is the main reason for use in barometers?
~~(a) High density~~
 (b) Negligible capillary effect
 (c) Very low vapour pressure
 (d) Low compressibility
39. In case of fluid flow through pipes, cavitation is caused by
 (a) high pressure
~~(b) high velocity~~
 (c) low pressure below a limit
 (d) weak material of pipe
40. A stream function
 (a) is a mathematical function which has no physical equivalence.
 (b) is defined only for steady and incompressible flow.
~~(c) satisfies Laplace equation for rotational motion.~~
 (d) may not remain constant for a streamline.
41. For the flow to occur between two points in a pipeline, the differential pressure between these points should be more than
 (a) surface friction
 (b) viscosity force
 (c) frictional force
~~(d) All of the above~~
42. Fluid is flowing in a curved path without any external impressed contact force. This flow is known as
~~(a) free vortex flow~~
 (b) forced vortex flow
 (c) radial flow
 (d) spiral flow
43. In fluid flow through pipes, transition from laminar to turbulent flow, does not depend on
~~(a) length of pipe~~
 (b) density of fluid
 (c) diameter of pipe
 (d) velocity of flow
44. In the region of boundary layer on a flat plate surface where velocity is not zero, the viscous force is
 (a) less than inertial force
 (b) more than inertial force
~~(c) equal in magnitude~~
 (d) not predictable



45. The magnitude of water hammer in the flow of a liquid through a pipe does not depend upon
- (a) length of pipe
 - (b) elastic properties of pipe material
 - ~~(c) temperature of liquid~~
 - (d) time of valve closure
46. Compressibility effect can be treated as negligible when Mach number is
- (a) upto 0.2
 - (b) upto 0.5
 - (c) less than 1
 - ~~(d) 1~~
47. A body is called streamline body when
- (a) it is symmetrical about the axis along the free stream.
 - ~~(b) surface of the body coincides with the streamlines.~~
 - ~~(c) flow is laminar around it.~~
 - (d) it produces no drag for flow around it.
48. Mach number is the ratio of
- (a) elastic force to gravity force
 - (b) viscous force to elastic force
 - ~~(c) inertial force to surface tension~~
 - (d) inertial force to elastic force
49. For a linear distribution of velocity in the boundary layer on a flat plate, the ratio of displacement thickness to nominal thickness is
- (a) $\frac{1}{4}$
 - (b) $\frac{1}{3}$
 - ~~(c) $\frac{1}{2}$~~
 - (d) $\frac{2}{3}$
50. In case of laminar flow through pipe, the ratio of total kinetic energy of fluid passing per second to the energy value obtained on the basis of average velocity is
- (a) 1.2
 - ~~(b) 1.54~~
 - ~~(c) 2.0~~
 - (d) 2.37
51. Sonic velocity will have a low value in the medium having
- (a) low value of coefficient of compressibility.
 - ~~(b) high value of coefficient of compressibility.~~
 - (c) high bulk modulus of elasticity.
 - (d) homogeneous composition.
52. An isentropic flow is one which is
- ~~(a) adiabatic and reversible~~
 - (b) isothermal only
 - (c) adiabatic only
 - (d) adiabatic and irreversible
53. The size of a venturimeter is specified by
- (a) fluid pressure
 - ~~(b) discharge~~
 - ~~(c) pipe diameter and throat diameter~~
 - (d) length of venturimeter
54. In a flow field at the stagnation point
- (a) pressure is zero.
 - (b) total energy is zero.
 - (c) pressure head is equal to velocity head.
 - ~~(d) All the velocity head is converted into pressure head.~~

55. Which two forces are most important in laminar flow between parallel plates ?
~~(a) Inertial and viscous~~
 (b) Viscous and pressure
 (c) Gravity and pressure
 (d) Pressure and inertial
56. A high value of thermal diffusivity represents
 (a) high storage, less conduction of heat.
~~(b) less storage, more conduction of heat.~~
 (c) There is always equal amount of conduction and storage since it is a property.
 (d) It has no relevance.
57. What happens when the thickness of insulation on a pipe exceeds the critical value ?
 (a) Heat transfer rate increases
~~(b) Heat transfer rate decreases~~
 (c) Heat transfer rate remains constant
 (d) None of these
58. For flow of fluid over a heated plate, the following fluid properties are known :
 Viscosity = 0.001 Pa.s, sp. heat at constant pressure = 1 kJ/kg-K, thermal conductivity = 1W/mK.
 The hydrodynamic boundary layer thickness at a specified location on the plate is 1 mm, the thermal boundary layer thickness at the same location is
 (a) 0.001 mm (b) 0.01 mm
~~(c) 1 mm~~ (d) 10 mm
59. Which one of the following configuration has the highest fin effectiveness ?
~~(a) thin, close spaced~~
 (b) thin, widely spaced
 (c) thick, widely spaced
 (d) thick, close spaced
60. In a condenser of a power plant, the steam condenses at a temperature of 60 °C. The cooling water enters at 30 °C and leaves at 45 °C. Logarithmic Mean Temperature Difference (LMTD) of the condenser is
 (a) 16.2 °C (b) 21.6 °C
~~(c) 30 °C~~ (d) 37.5 °C
61. In a heat exchanger, the temperature of the hot fluid decreases while the temperature of the cold fluid increases. The increase and decrease following :
 (a) A quadratic law
 (b) A linear law
 (c) A cubic law
~~(d) An exponential law~~
62. Which substance has the minimum value of thermal conductivity ?
~~(a) Air~~ (b) Water
 (c) Plastic (d) Rubber
63. Lumped parameter analysis for transient heat conduction is essentially valid of
 (a) $B_i < 0.1$ ~~(b) $0.1 < B_i < 0.5$~~
 (c) $1 < B_i < 10$ (d) $B_i \rightarrow \infty$

64. Cork is a good thermal insulator because
 (a) Its density is low.
 (b) It is porous.
 (c) It can be powdered.
~~(d) It is flexible.~~
65. Unsteady state of heat flow occurs in
 (a) Flow of heat through furnace walls.
 (b) Flow of heat through insulated pipe with constant surface temperature.
~~(c) Annealing of castings.~~
 (d) Flow of heat through refrigerator walls.
66. The temperature inside a furnace is generally measured by
 (a) Mercury thermometer
 (b) Alcohol thermometer
 (c) Gas thermometer
~~(d) Optical pyrometer~~
67. Heat is transferred by conduction, convection and radiation in
 (a) Insulated pipes carrying hot water
 (b) Refrigerator freezer coils
 (c) Melting of ice
~~(d) Boiler furnaces~~
68. The density of water is maximum at
 (a) 20 °C ~~(b) 4 °C~~
 (c) 0 °C (d) - 4 °C
69. Which non-metallic body is expected to have highest value of emissivity ?
 (a) Iron oxide (b) Carbon
~~(c) Ice~~ (d) Paper
70. The rate of heat transfer by conduction in pipes at critical radius is
~~(a) equal to the rate of heat transfer by convection and is maximum.~~
 (b) equal to the rate of heat transfer by convection and is minimum.
 (c) greater than the rate of heat transfer by convection.
 (d) less than the rate of heat transfer by convection
71. The heat transfer coefficient over the surface of a pin fin decreases, then
~~(a) its effectiveness will decrease.~~
~~(b) its effectiveness will increase.~~
 (c) its effectiveness will remain unchanged.
 (d) its effectiveness will first increase and then decrease.
72. The critical radius of insulation for a sphere is equal to
 (a) $2kh$ (b) $\frac{h}{2k}$
~~(c) $\frac{2k}{h}$~~ (d) $\sqrt{2kh}$
- Where symbols have usual meanings.
73. In a cylinder under steady state conduction with uniform heat generation, the temperature gradient at half the radius location will be
~~(a) one half of that at surface~~
 (b) one fourth of that at surface
 (c) twice that at surface
 (d) four times that at surface

74. For the quick response of a thermocouple
 (a) its wire diameter should be large.
~~(b) the convective heat transfer coefficient should be high.~~
 (c) the specific heat should be high.
 (d) the density should not be very small.
75. If Nusselt number is 390, Reynolds number is 39 and Prandtl number is 20, then Stanton number will be
 (a) 780 (b) 200
 (c) 2 ~~(d) 0.5~~
76. The temperature of a solid surface is raised from 227 °C to 727 °C. The emissive power of the body will change from E_1 to E_2 such that E_2/E_1
 (a) 400 ~~(b) 16~~
 (c) 4000 (d) 1600
77. For an opaque body sum of absorptivity and reflectivity is
~~(a) 0~~
 (b) 1.0
 (c) less than 1.0
 (d) greater than 1.0
78. Efficiency of a Diesel cycle will approach to Otto cycle when
 (a) diesel engine will operate at high speed.
~~(b) cut-off period of diesel cycle is reduced to zero.~~
 (c) diesel fuel is balanced with petrol.
 (d) None of these.
79. A gas turbine cycle with heat exchanger and reheating improves
 (a) only the thermal efficiency.
 (b) only the specific power output.
~~(c) both thermal efficiency and specific power output.~~
 (d) neither thermal efficiency nor specific power output.
80. The ideal efficiency of simple gas turbine cycle depends upon
~~(a) pressure ratio~~
 (b) cut-off ratio
 (c) both (a) and (b)
 (d) None of the above
81. The area of a p-v diagram for a Carnot cycle represents
 (a) heat supplied
~~(b) heat rejected~~
~~(c) work done~~
 (d) temperature drop
82. For a given set of operating pressure limits of a Rankine cycle the highest efficiency occurs
 (a) Saturated cycle
 (b) Superheated cycle
~~(c) Reheat cycle~~
 (d) Regenerative cycle
83. Which process is responsible for production of energy in the Sun ?
~~(a) Nuclear fission reaction~~
~~(b) Nuclear fusion reaction~~
 (c) Exothermal chemical reaction
 (d) All of the above

84. Terrestrial radiation has a wavelength in the range of
 (a) $0.2 \mu\text{m}$ to $4 \mu\text{m}$
~~(b) $0.2 \mu\text{m}$ to $0.5 \mu\text{m}$~~
 (c) $0.380 \mu\text{m}$ to $0.760 \mu\text{m}$
 (d) $0.29 \mu\text{m}$ to $2.3 \mu\text{m}$
85. A solar thermal collector
 (a) collects the solar energy and reflects it back.
 (b) absorbs the solar radiation and dissipates it to the ambient.
 (c) collects and converts the solar energy into electrical energy.
~~(d) collects and converts the solar energy into thermal energy and delivers it to the next stage of the system.~~
86. A solar cell is basically
~~(a) a voltage source, controlled by flux of radiation.~~
 (b) a current source, controlled by flux of radiation.
 (c) an uncontrolled current source
 (d) an uncontrolled voltage source
87. The working fluid used in an MHD system coupled to a fast breeder reactor is
 (a) hot flue gases
 (b) seeded inert gas
~~(c) liquid metal inert gas~~
 (d) liquid metal only
88. For the same maximum pressure and temperature
~~(a) Otto cycle is more efficient than diesel cycle.~~
 (b) Diesel cycle is more efficient than Otto cycle.
 (c) Dual cycle is more efficient than Otto and Diesel cycle.
 (d) Dual cycle is less efficient than Otto and Diesel cycle.
89. Consider the following emissions of an I.C. engine.
 1. CO_2 2. HC
~~3. NO_x~~ 4. Particulate
 Which of these emissions causes photochemical smog?
 (a) 1 and 4 (b) 1 and 2
 (c) 2 and 3 ~~(d) 3 and 4~~
90. Consider the following statements :
 Knock in the S.I. engine can be reduced by
 1. Supercharging
 2. Retarding the spark
 3. Using a fuel of long straight chain structure.
 4. Increasing the engine speed.
 Of these correct statements are
 (a) 1 and 2 ~~(b) 2 and 3~~
 (c) 1, 3 and 4 (d) 2 and 4
91. Which of the following is considered to be superior quality coal for power plants?
~~(a) Bituminous coal~~
 (b) Peat
 (c) Coke
 (d) Lignite

92. A curve showing the variation of load on a power station with respect to time is known as
 (a) Load curve
 (b) Load duration curve
 (c) Diversity factor
~~(d) Performance curve~~
93. The capacity of generators being installed in super thermal power plant is
 (a) 100 MW (b) 200 MW
 (c) 400 MW ~~(d) 500 MW~~
94. Fuel injection pressure in solid injection system is approximately in the range of
 (a) < 10.5 bar ~~(b) 10.5 – 21 bar~~
 (c) 30 – 50 bar (d) 200 – 246 bar
95. The thermal efficiency of a gas turbine cycle with ideal regenerative heat exchanger is
 (a) equal to work ratio
 (b) less than work ratio
~~(c) more than work ratio~~
 (d) unpredictable
96. The ratio of work done to the energy supplied to rotor in a turbine stage is called
~~(a) blade efficiency~~
 (b) stage efficiency
 (c) nozzle efficiency
 (d) None of these
97. The diagram efficiency is highest for simple impulse turbine stage having smooth and symmetrical blade when blade steam speed ratio can be given as
 (a) $\cos \alpha_1$ (b) $\frac{\cos \alpha_1}{4}$
~~(c) $\frac{\cos \alpha_1}{2}$~~ (d) None of these
 Where α_1 is the angle of absolute velocity at inlet.
98. What will happen to the volumetric efficiency with increasing pressure ratio in case of single stage compression in compressions?
~~(a) Decreases~~
 (b) Increases
 (c) Remains unaffected
~~(d) None of these~~
99. The compression work requirement is minimum in case of compression process being
 (a) Adiabatic ~~(b) Isochoric~~
 (c) Isothermal (d) Hyperbolic
100. If a mass of moist air in an air tight vessel is heated to a higher temperature, then
 (a) specific humidity of the air increases.
 (b) specific humidity of the air decreases.
~~(c) relative humidity of the air increases.~~
 (d) relative humidity of the air decreases.