

# ENGINEERING ACADEMY DEHRADUN

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## MECHANICAL TEST PAPER

21-04-2017

- One of the extensive properties of a thermodynamic system amongst the following is
  - pressure
  - volume
  - temperature
  - density
- A heat engine is supplied with 278 kW of heat at a constant fixed temperature of 283 °C and the heat rejection takes place at 5°C. The engine is reversible if the heat rejected, in kW, is
  - 139
  - 208
  - 35
  - 70
- When wet steam flows through a throttle valve
  - its temperature increases and dryness improves
  - its temperature increases but dryness decreases
  - its temperature decreases but dryness improves
  - its temperature and dryness decrease
- If two liquids at different temperatures are mixed, then the final temperature of the mixture of liquids can be obtained by using
  - Zeroth law of thermodynamics
  - First law of thermodynamics
  - Second law of thermodynamics
  - Third law of thermodynamics
- For an irreversible thermodynamic cycle
  - $\int \frac{dQ}{T} > 0$
  - $\int \frac{dQ}{T} < 0$
  - $\int \frac{dQ}{T} \geq 0$
  - $\int \frac{dQ}{T} \leq 0$
- The enthalpy of evaporation of water
  - decreases with increase in pressure
  - decreases with decreases in pressure
  - increases with increase in pressure
  - remains unaffected by change in pressure
- In a throttling process, the following thermodynamic property remains constant:
  - Enthalpy
  - Entropy
  - Specific heat
  - Energy
- Heat supplied to a system equals the work done in case of non-flow process carried out
  - Isochorically
  - Isobarically
  - Isothermally
  - Adiabatically
- Neglecting changes in potential and kinetic energies, the shaft work during a steady flow process is given by
  - $\int pdv$
  - $\int vdp$
  - $\int Tds$
  - $\int sdT$
- For a convergent nozzle, if the exit pressure is less than critical pressure, the mass rate of flow will be
  - increasing
  - decreasing
  - zero
  - constant
- Brayton cycle is a reversed
  - Carnot cycle
  - Rankine cycle
  - Joule cycle
  - Dual cycle
- Critical pressure for steam is
  - 252 bar
  - 225 bar
  - 184 bar
  - 163 bar
- Maximum steam pressure (in bar) in a locomotive builder is limited to
  - 5
  - 10
  - 18
  - 25
- Compounding of steam turbine is done to
  - balance the rotor
  - reduce the blade friction
  - reduce the rotor speed
  - connect the shaft of one turbine to that of another
- For a nozzle to convert subsonic flow into a supersonic flow, it must be
  - convergent type
  - divergent type
  - convergent-divergent type
  - of uniform cross-sectional area
- A reversible heat engine working at the rate of 100 kW has an efficiency of 20%. The magnitudes of heat transfer rate from the source and to the sink in kW would be, respectively,
  - 200, 100
  - 300, 200
  - 500, 400
  - 1000, 900
- The boiling and freezing points for water are marked on a temperature scale P as 130°P and -20°P respectively. What will be the reading on this scale corresponding to 60°C on Celsius scale?
  - 60°P
  - 70°P
  - 90°P
  - 110°P
- In a reaction turbine, the heat drop in fixed blade is 8 kJ/kg and total heat drop per stage is 20 kJ/kg. The degree of reaction is
  - 40%
  - 60%

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- c) 66.7%                      d) 80%

19. A closed balloon containing 10 kg of helium receives 5 kJ/kg of heat. During this process, the volume of the balloon slowly increases by 0.2 m<sup>3</sup> at constant pressure of 100 kPa. The change in internal energy, in kJ, is

- a) 10                              b) 20  
c) 30                              d) 70

20. **Assertion (A) :**

If a hot metal ball is quenched in a liquid of low temperature, heat transfer will take place from metal ball to liquid and not in the reverse direction

**Reason (R) :**

Heat transfer process from hot metal ball to liquid at lower temperature complies with the increase of entropy principle i.e.  $S_{gen} \geq 0$  and the reverse process does not

- a) Both A and R are true and R is the correct explanation of A  
b) Both A and R are true, but R is not the correct explanation of A  
c) A is true, but R is false  
d) R is true, but A is false

21. 38. A gas in a container A is in thermal equilibrium with another gas of the same mass in container B. If the corresponding pressures and volumes are denoted by suffixes A and B, then which of the following statements is true?

- a)  $P_A \neq P_B, V_A = V_B$   
b)  $P_A = P_B, V_A \neq V_B$   
c)  $\frac{P_A}{V_A} = \frac{P_B}{V_B}$   
d)  $P_A V_A = P_B V_B$

22. A liquid flows from low level  $Z_1$ , pressure  $P_1$  to higher level  $Z_2$ , pressure  $P_2$ . It can be concluded

- a) first law of thermodynamics has been violated  
b) second law of thermodynamics has been violated  
c)  $Z_2 < Z_1$   
d)  $P_2 < P_1$

23. Which of the following expressions gives the entropy change in an isobaric heating process from  $T_1$  and  $T_2$ ?

- a)  $mC_p \ln \frac{T_2}{T_1}$   
b)  $mC_p (T_2 - T_1)$   
c)  $mC_p (T_2 - T_1)/T_0$   
d)  $mC_p (T_2 + T_1)$

24. If  $V_i$  be the inlet absolute velocity to blades,  $V_b$  be the tangential blade velocity and  $\alpha$  be the nozzle angle, then for maximum blade efficiency for single-stage impulse turbine

- a)  $\frac{V_b}{V_i} = \cos \alpha$                       b)  $\frac{V_b}{V_i} = \frac{\cos \alpha}{2}$   
c)  $\frac{V_b}{V_i} = \cos^2 \alpha$                       d)  $\frac{V_b}{V_i} = \frac{\cos^2 \alpha}{2}$

25. Which of the following does not relate to steam engine?

- a) Crank shaft                      b) Cross head  
c) Steam chest                      d) Steam separator

26. What salts of calcium and magnesium cause temporary hardness of boiler feed water?

- a) Chlorides                      b) Bicarbonates  
c) Nitrates                      d) Sulphites

27. In an isothermal process, the internal energy

- a) always increases  
b) always decrease  
c) increases or decreases  
d) remain constant

28. Which of the following is a boiler mounting?

- a) Safety valve                      b) Economizer  
c) Superheater                      d) Feed pump

29. An adiabatic process in a thermodynamic system is one in which there is

- a) a limited heat transfer to or from the system through the boundary  
b) no heat transfer to or from the system through the boundary  
c) no energy transfer to or from the system through the boundary  
d) no internal energy change in the system

30. A device used to increase the temperature of saturated steam without raising its pressure is called

- a) fusible plug                      b) blow off cock  
c) economiser                      d) superheater

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## **MECHANICAL ANS KEY**

**21-04-2017**

1. Ans: b)
2. Ans: a)
3. Ans: a)
4. Ans: b)
5. Ans: b)
6. Ans: c)
7. Ans: a)
8. Ans: c)
9. Ans: c)
10. Ans: d)
11. Ans: d)
12. Ans: b)
13. Ans: c)
14. Ans: c)
15. Ans: c)
16. Ans: c)
17. Ans: b)
18. Ans: b)
19. Ans: c)
20. Ans: a)
21. Ans: d)
22. Ans: d)
23. Ans: a)
24. Ans: b)
25. Ans: d)
26. Ans: b)
27. Ans: d)
28. Ans: a)
29. Ans: b)
30. Ans: d)

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