UKPSC JE 2013 PAPER - II

Q1. The relationship between two specific heats C_P and C_V is

(a) C_P / C_V = γ – 1 (b) C_P - C_V = R/J

(c) C_P - C_V = J/R (d) C_P + C_V = J

Q2. The efficiency of a Carnot engine depends on

(a) Type of fuel

(b) Size of engine

(c) Design of engine

(d) Temperature of source and sink

Q3. Second law of thermodynamics defines

(a) Entropy (b) Enthalpy

(c) Heat (d) Work

Q4. In an isothermal process, the internal energy

(a) Increases

(b) Decreases

(c) Remains constant

(d) First increases then decreases

Q5. Maximum work is done in compressing air when the compression is done in

(a) Isothermal process

(b) Adiabatic process

(c) Polytropic process

(d) None of these

Q6. What will be the volume of air at 327 °C if its volume at 27 °C is 1.5 m^3?

(a) 3 m^3 (b) 1.5 m^3

(c) 6 m^3 (d) 10 m^3

Q7. Reciprocating air compressor is best suited for

(a) Large quantity of air at high pressure

(b) Small quantity of air at high pressure

(c) Small quantity of air at low pressure

(d) Large quantity of air at low pressure

Q8. Losses in a centrifugal compressor are due to

(a) Inlet losses (b) Impeller channel losses

(c) Diffuser losses (d) All of these

Q9. Which of the following cycles uses air as the refrigerant?

(a) Ericsson (b) Stirling

(c) Carnot (d) Bell-Coleman

Q10. One ton of refrigeration is equal to

(a) 210 kJ/min (b) 21 kJ/min

(c) 420 kJ/min (d) 620 kJ/min

Q11. The refrigerant for a refrigerator should have

(a) High sensible heat (b) High total heat

(c) High latent heat (d) Low latent heat

Q12. If a heat pump cycle operates between the condenser temperature of +27 °C and evaporator temperature of – 23 °C, then the Carnot COP will be

(a) 0.2 (b) 1.2

(c) 5 (d) 6

Q13. Which of the following refrigerants has lowest freezing point?

(a) Freon – 12 (b) NH_3

(c) CO_2 (d) Freon-22

Q14. If P_V is partial pressure of water vapour in air and P_S is saturation pressure of water vapour at same temperature, then relative humidity is equal to

(a) P_V/P_S (b) P_S/P_V

(c) $P_S - P_V$ (d) $P_V - P_S$

Q15. Indication of amount of moisture in air is given by

(a) Dry bulb temperature

(b) Wet bulb temperature

(c) Dew point temperature

(d) Saturation temperature

Q16. As relative humidity decreases, the dew point will be

(a) Lower than wet bulb temperature

(b) Higher than wet bulb temperature

(c) Equal to wet bulb temperature

(d) None of these

Q17. Sensible heat is the heat needed to

(a) Vaporise water into steam and vice versa

(b) Change the temperature of a liquid or vapour

(c) Convert water into steam and super heat it

(d) Measure dew point temperature

Q18. Which of the following is the unit of entropy?

(a) J/kg °k (b) Nm/kg sec

(c) J/kg (d) Nm/sec

Q19. The difference of pressure between the inside and outside of a liquid drop is

(a) P = T × r (b) P = T/r

(c) P = T/2r (d) P = 2T/r

Q20. Newton's law of viscosity is a relationship between

(a) Shear stress and rate of angular distortion

(b) Shear stress and viscosity

(c) Pressure, velocity and viscosity

(d) Shear stress, pressure and rate of angular distortion

Q21. The curved lines on a psychrometric chart indicates

(a) Specific humidity (b) relative humidity

(c) DBT (d) WBT

Q22. Ratio of inertia force to surface tension is known as

(a) Mach number (b) Froude number

(c) Reynold's number (d) Weber's number

Q23. Friction factor of pipes depends on

(a) Rate of flow (b) Fluid density

(c) Viscosity (d) All of these

Q24. Pelton wheels are used for minimum of following heads:

(a) 20 m (b) 150 m

(c) 25 m (d) 200 m or above

Q25. If 'α' is the angle of blade tip at outlet, then maximum hydraulic efficiency of an impulse turbine is

(a) $\frac{1 + cos\ \alpha}{2}$ (b) $\frac{1 - cos\ \alpha}{2}$

(c) $\frac{1 + sin\ \alpha}{2}$ (d) $\frac{1 - sin\ \alpha}{2}$

Q26. The melting point of the filler metal in brazing should be above

(a) 420 °C (b) 600 °C

(c) 1530 °C (d) 800 °C

Q27. Moulding sands are graded according to their

(a) Permeability

(b) Clay content and grain size

(c) Strength

(d) None of these

Q28. Hot tear is related to

(a) Casting defect

(b) Process of fabrication

(c) Heat treatment

(d) Welding of non-ferrous metals

Q29. Large and heavy castings are made by

(a) Green sand moulding

(b) Pit moulding

(c) Dry sand moulding

(d) Pressure moulding

Q30. In which of the following welding process consumable electrode is used?

(a) TIG (b) MIG

(c) Thermit (d) Laser

Q31. Arc stability is better with

(a) AC welding

(b) DC welding

(c) Both AC & DC welding

(d) None of these

Q32. Which of the following brazing joints is strongest?

(a) Butt (b) Scarf (inclined)

(c) Lap (d) All are equally strong.

Q33. The important property of a material in all metal forming processes is

(a) Elasticity (b) Plasticity

(c) Ductility (d) Brittleness

Q34. If V is volume of metal in casting and A is its surface area, then time of solidification of metal will be proportional to

(a) $V, \frac{1}{A}$ (b) V, $\frac{1}{A^2}$

(c) V^2 (d) V, A

Q35. Spinning process is carried out by

(a) Hydraulic press (b) Mechanical press

(c) Lathe (d) Milling machine

Q36. Which of the following process is used for gear finishing?

(a) Hobbing

(b) Shaping

(c) Milling

(d) Shaving or burnishing

Q37. The ductility of a material after work hardening

(a) Increases (b) Decreases

(c) Remains unaltered (d) None of these

Q38. Lathe bed is usually made of

(a) Structural steel (b) Stainless steel

(c) Cast iron (d) Mild steel

Q39. In blanking operation, the angle of shear is provided on

(a) Die

(b) Punch

(c) Both on punch and die

(d) None of these

Q40. Tool life is most affected by

(a) Cutting speed (b) Tool geometry

(c) Feed and depth (d) None of these

Q41. On tool surface, crater wear occurs mainly due to

(a) Abrasion (b) Diffusion

(c) Oxidation (d) Adhesion

Q42. In machining process, chips break due to

(a) Plasticity (b) elasticity

(c) Work hardening (d) None of these

Q43. No cutting fluid is used while machining which metal?

(a) Mild steel (b) Carbon steel

(c) Aluminium (d) Cast iron

Q44. Which of the following metals can be easily drawn into wire?

(a) Tin (b) Copper

(c) Zinc (d) Cast iron

Q45. The composition of silver solder is

(a) Silver, copper, zinc

(b) Silver, tin, zinc, nickel

(c) Silver, nickel

(d) Silver, copper, nickel

Q46. Muntz metal contains copper and zinc in the ratio of

(a) 50 : 50 (b) 40 : 60

(c) 60 : 40 (d) 80 : 20

Q47. In electro discharge machining the tool is made of

(a) Tungsten carbide (b) Diamond

(c) Copper or brass (d) Stainless steel

Q48. The cutting tool used in spark erosion machining process is called

(a) Arc (b) Capacitor

(c) Electrode (d) Dielectric

Q49. Anvil is made of which of the following metal?

(a) Mild steel (b) Cast steel

(c) Copper (d) Brass

Q50. Which of the following are discrete products?

(a) Nut (b) Bolt

(c) Screw (d) All of these

Q51. Which of the following are continuous products?

(a) Sheets (metallic) (b) Pipes

(c) Wire rolls (d) All of these

Q52. Grate is the place in the boiler where

(a) Fuel is burnt

(b) Pressure of steam is measured

(c) Temperature of saturated steam is increased

(d) None of the above

Q53. Boiler rating is usually defined in terms of

(a) Maximum temperature of steam

(b) Heat transfer rate kJ/hr

(c) Heating surface area

(d) Heating output in kg/hr

Q54. Thermal efficiency of an ideal diesel cycle

(a) Increases with increase in cut-off ratio

(b) Decreases with increase in cut-off ratio

(c) Does not depend on cut-off ratio

(d) May increase or decrease with increase in cut-off ratio

Q55. Chemically correct air-fuel ratio by mass for combustion of petrol is approximately

(a) 5 (b) 10

(c) 12 (d) 15

Q56. In magneto ignition system, as the engine speed increases, the value of current

(a) Increases

(b) Decreases

(c) Remains the same

(d) May increase or decrease

Q57. If the temperature of intake air in an I.C. engine is lowered, its efficiency will

(a) Increase

(b) Decrease

(c) Remains unchanged

(d) Will increase upto certain limit and then decrease

Q58. In a gas turbine cycle with regeneration

(a) Pressure ratio increases

(b) Work output decreases

(c) Thermal efficiency increases

(d) Heat input increases

Q59. The term 'priming' in boiler is associated with

(a) Removal of air from the boiler shell

(b) Water particles being carried by steam

(c) Firing of boiler

(d) Control of rate of fuel consumption

Q60. Compression ratio in I.C. engine is defined as the ratio of

(a) Total cylinder volume to swept volume

(b) Total cylinder volume to clearance volume

(c) Swept volume to clearance volume

(d) None of the above

Q61. Higher octane rating for S.I. engine fuel indicates that it has

(a) Higher calorific value

(b) Higher volatility

(c) Higher ignition lag

(d) Lower ignition lag

Q62. Air standard efficiency of an Otto cycle having compression ratio of 5 will be

(a) $1 - 5^{\gamma-1}$ (b) $1 - \frac{1}{5^{\gamma-1}}$

(c) $1 + \frac{1}{5^{\gamma-1}}$ (d) None of these

Q63. Most important property of I.C. engine lubricant is

(a) Density

(b) Viscosity

(c) Thermal conductivity

(d) None of these

Q64. The throttling operation in a domestic refrigerator is carried out in

(a) Evaporator (b) Capillary tube

(c) Expansion valve (d) Condenser

Q65. Household refrigerators operate on

(a) Reversed Carnot cycle

(b) Cascade refrigeration cycle

(c) Vapour absorption cycle

(d) Vapour compression cycle

Q66. When water – Lithium Bromide is used in a vapour absorption refrigeration system, then

(a) They together act as refrigerant.

(b) Water is the refrigerant.

(c) Lithium bromide is refrigerant.

(d) None of these

Q67. For saturated air, the dew point temperature is

(a) Equal to WBT (b) less than WBT

(c) more than WBT (d) None of these

Q68. Process of sensible heating

(a) Increases specific humidity

(b) Decreases specific humidity

(c) Decreases relative humidity

(d) Increases relative humidity

Q69. Psychrometer is a device which is used to measure

(a) Dry bulb temperature

(b) Wet bulb temperature

(c) Dry bulb and wet bulb temperature simultaneously

(d) dew-point

Q70. In vapour absorption refrigeration, heat is rejected in

(a) Condenser only

(b) Generator only

(c) Absorber only

(d) Both condenser and absorber

Q71. A heat pump working on a reversed Carnot cycle has a COP of 4. It is made to work as refrigerator with 1 kW work input. The refrigerating effect will be

(a) 1 (b) 2

(c) 3 (d) 4

Q72. In conventional refrigerants, which element is responsible for ozone depletion?

(a) Chlorine (b) Carbon

(c) Hydrogen (d) Fluorine

Q73. Bernoulli's equation refers to conservation of

(a) Mass (b) Energy

(c) Momentum (d) None of these

Q74. Falling drops of water become spherical in shape due to the property of

(a) Adhesion (b) Cohesion

(c) Surface tension (d) Viscosity

Q75. The pressure at a depth of 5 km below the surface of the sea water, considering sp. gravity of water to be 1.3, will be

(a) 63765 Pa (b) 637650 Pa

(c) 1.27 × 108Pa (d) 1.27 × 109Pa

Q76. The velocity of liquid flowing through the divergent portion of a venturimeter

(a) Increases (b) Decreases

(c) Remains constant (d) Cannot be predicted

Q77. The shear stress at a point 5 cm from the pipe axis is 20 Pa. The value of shear stress at the pipe wall, having diameter 20 cm will be

(a) 40 Pa (b) 80 Pa

(c) 50 Pa (d) cannot be determined

Q78. The value of velocity ratio for Kaplan turbine is about

(a) 0.5 (b) 0.9

(c) 1.5 (d) 2.0

Q79. Which of the following turbine does not require draft tube?

(a) Kaplan turbine (b) Pelton turbine

(c) Francis turbine (d) Propeller turbine

Q80. The vanes of centrifugal pumps are usually

(a) Curved forward (b) Curved backward

(c) Radial (d) None of these

Q81. Notch is a device used for the measurement of

(a) Rate of flow through pipes

(b) Rate of flow through small channel

(c) Velocity through pipes

(d) Velocity through small channels

Q82. In centrifugal pump, the liquid enters

(a) At the centre (b) at the bottom

(c) At the top (d) from sides

Q83. Francis turbine is used when the available head of water range in

(a) 0 – 25 m (b) 60 – 250 m

(c) Above 250 m

(d) Can be used for any head

Q84. Copper sheets are manufactured by process of

(a) Drawing (b) Rolling

(c) Extruding (d) Hammering

Q85. Dies for wire drawing are made of the following material:

(a) Cast iron (b) Wrought iron

(c) Mild steel (d) Carbides

Q86. The type of welding used for car bodies is

(a) Resistance welding (b) Gas welding

(c) Arc welding (d) None of these

Q87. Commonly used flame in gas welding is

(a) Neutral (b) Oxidising

(c) Carburising (d) None of these

Q88. Which of the following sands is used to keep away the green sand from sticking to the pattern?

(a) Core sand (b) Parting sand

(c) Loam sand (d) Synthetic sand

Q89. Sprue in casting refers to

(a) Gate (b) Runner

(c) Riser (d) vertical passage

Q90. The main function of cutting fluid is to

(a) Wash away the chips

(b) Provide lubrication

(c) Cool the tool and workpiece

(d) All of these

Q91. In which of the following operation on lathe, spindle speed is minimum?

(a) Knurling (b) Taper turning

(c) Fine finishing (d) Thread cutting

Q92. The size of shaper is specified by

(a) Length of stroke

(b) Size of tool

(c) Ratio of forward to return stroke

(d) Size of table

Q93. Enlarging of an existing circular hole with a rotating single point tool is called

(a) Boring (b) drilling

(c) Reaming (d) internal turning

Q94. Which of the following material is used as binding material for grinding wheels?

(a) Silicon carbide (b) Sodium silicate

(c) Boron carbide (d) Aluminium oxide

Q95. The cutting edges of a standard twist drill are called

(a) Cutting lip (b) Flanks

(c) Flutes (d) Wedges

Q96. Which of the following is the natural abrasive?

(a) Al_2O_3 (b) SiC

(c) Boron carbide (d) Corundum

Q97. For which material, the cutting speed will be minimum for machining?

(a) Aluminium (b) Brass

(c) Copper (d) Cast iron

Q98. The purpose of using flux in soldering is to

(a) Increase fluidity of solder metal

(b) Prevent oxides formation

(c) Wash away the surplus solder

(d) Lowering the melting temperature of solder

Q99. In sand moulding, the middle part of flask is called

(a) Cope (b) Drag

(c) Cheek (d) Middle flask

Q100. Least shrinkage allowance is provided for the following:

(a) Brass (b) Aluminium

(c) Cast iron (d) Lead

Q101. A knee is part of the following:

(a) Shaper (b) Lathe

(c) Milling machine (d) Slotter

Q102. Seasoning of timber refers to

(a) Removing of moisture

(b) Adding moisture

(c) Cutting in desired shape

(d) Removing curves

Q103. Which is the hardest wood?

(a) Teak (b) Tun

(c) Shisham (d) Babul

Q104. Poise is the unit of

(a) Mass density (b) Kinematic viscosity

(c) Dynamic viscosity (d) Velocity gradient

Q105. Continuity equation can take the form

(a) $A_1 v_1 = A_2 v_2$

(b) $\rho_1 A_1 = \rho_2 A_2$

(c) $\rho_1 A_1 v_1 = \rho_2 A_2 v_2$

(d) None of these

Q106. Two stroke engines have

(a) Valves (b) Ports

(c) Both (a) & (b) (d) None of these

Q107. Compression ratio of diesel engine is in the range of

(a) 8 to 10 (b) 10 to 15

(c) 16 to 20 (d) None of these

Q108. Steam turbines are governed by the following methods:

(a) Throttle governing

(b) Nozzle control governing

(c) By-pass governing

(d) All of these

Q109. For Parson's reaction steam turbine, degree of reaction is

(a) 75% (b) 100%

(c) 50% (d) 60%

Q110. Boiler mountings are necessary for

(a) Operation and safety of a boiler

(b) Increase the efficiency of boiler

(c) Both (a) and (b)

(d) None of these

Q111. Babcock & Wilcox boiler is

(a) Water tube type (b) Fire tube type

(c) Both (a) and (b) (d) None of these

Q112. Range of high pressure boilers are

(a) Below 80 bar (b) Above 80 bar

(c) 40 to 80 bar (d) 60 to 80 bar

Q113. Dry ice is

(a) Free from water

(b) Free from dissolved air or gases

(c) Does not contain impurities

(d) Solidified form of carbon dioxide

Q114. A simple pitot tube is used to measure

(a) Pressure in a static fluid

(b) Velocity in a flowing stream

(c) Total pressure

(d) Dynamic pressure

Q115. The boundary layer on a flat plate is called laminar boundary layer if

(a) Re is less than 2000

(b) Re is less than 4000

(c) Re is less than 5×10^5

(d) None of these

Q116. Capillary action is due to the

(a) Viscosity of liquid

(b) Cohesion of liquid particles

(c) Surface tension

(d) None of these

Q117. Cavitation is caused by

(a) High velocity

(b) Low barometric pressure

(c) High pressure

(d) Low pressure

Q118. Power required to drive a centrifugal pump is proportional to

(a) Speed (N) (b) N^2

(c) N^3 (d) $\frac{1}{N^2}$

Q119. Continuous chip may be formed while machining

(a) Brittle material (b) Hard material

(c) Tough material (d) Ductile material

Q120. In which type of welding, molten metal is poured for joining the metals?

(a) Arc welding (b) Thermit welding

(c) MIG (d) TIG

Q121. Grey iron is usually welded by

(a) Arc welding (b) Gas welding

(c) TIG (d) MIG

Q122. The process of cutting thin gears from metal sheet is known as

(a) Extruding (b) Stamping

(c) Sintering (d) Rolling

Q123. Which wood can be used for making patterns?

(a) Mahogany (b) Pine wood

(c) Teak wood (d) Any of these

Q124. Cohesiveness of sand depends on

(a) Grain size and shape of sand particles

(b) Bounding material

(c) Moisture content

(d) All of these

Q125. Electronic components are often joined by

(a) Adhesive (b) Soldering

(c) Brazing (d) Welding

Q126. Which of the following is basically a polishing operation?

(a) Soft grinding (b) Lapping

(c) Honing (d) Buffing

Q127. The depth of cut depend on the

(a) Cutting speed

(b) Tool material

(c) Rigidity of machine tool

(d) All of these

Q128. The commonly used material for thermocouples is

(a) Chromel – copper (b) Chromel – alumel

(c) Platinum – rhodium (d) Any of these

Q129. The gases used in tungsten inert gas welding are

(a) Helium and neon (b) Argon and helium

(c) Ozone and neon (d) None of these

Q130. The chemical formulae for Freon – 12 is

(a) $CHClF_2$ (b) CH_3Cl

(c) CCl_2F_2 (d) None of these

Q131. The function of a regenerator in a gas turbine is to

(a) Reduce heat loss in exhaust

(b) Permit use of higher compression ratio

(c) Improve thermal efficiency

(d) None of these

Q132. The bottom ring on the piston is known as

(a) Oil ring (b) Scraper ring

(c) Compression ring (d) Groove ring

Q133. A fly cutter is used on

(a) Lathe

(b) Capstan lathe

(c) Metal spining lathe

(d) Milling machine

Q134. The flow rate through a circular pipe is measured by

(a) Pitot tube (b) Venturimeter

(c) Orifice meter (d) both (b) and (c)

Q135. A pump is defined as a device which converts

(a) Hydraulic energy into mechanical energy

(b) Mechanical energy into hydraulic energy

(c) Kinetic energy into mechanical energy

(d) None of the above

Q136. The following is a vertical type boiler

(a) Lancashire boiler (b) Cornish boiler

(c) Cochran boiler (d) Locomotive boiler

Q137. A boiler mounting used to put-off fire in the furnace when water level in the boiler falls below a safe limit:

(a) Blow off cock (b) Stop valve

(c) Feed check valve (d) Fusible plug

Q138. In a Brayton cycle, the air enters the compressor at 300 K and maximum temperature

of cycle is 1200 K. What will be the thermal efficiency of cycle for maximum power output?

(a) 75% (b) 25%

(c) 50% (d) None of these

Q139. In an engine working on Otto cycle, air-fuel mixture is compressed from 400 C.C. to 100 C.C. If γ = 1.5, calculate the thermal efficiency of cycle.

(a) 50% (b) 55%

(c) 68% (d) None of these

Q140. The engine part that joins piston and piston rod is called

(a) Piston crown (b) Piston ring

(c) Crank pin (d) Gudgeon pin

Q141. The process of scavenging is related to

(a) Two stroke engine

(b) Four stroke engine

(c) Gas turbine

(d) Compressor

Q142. An axial flow compressor will have symmetrical blades for a degree of reaction:

(a) 25% (b) 50%

(c) 75% (d) 100%

Q143. The function of lubrication in engines are

(a) Lubrication and cooling

(b) Cleaning, sealing and noise reduction

(c) Efficiency enhancement

(d) Both (a) and (b)

Q144. A reciprocating compressor having 0.20 m bore and 0.25 m stroke runs at 600 rpm. If the actual volume delivered by compressor is 4 m^3/min, its volumetric efficiency will be about

(a) 70% (b) 75%

(c) 80% (d) 85%

Q145. In which cycle, all the four processes are not reversible?

(a) Carnot cycle

(b) Joule cycle

(c) Vapour compression cycle

(d) None of these

Q146. Wet compression in vapour compression cycle means

(a) Presence of water in refrigerant vapour during compression

(b) Presence of liquid refrigerant in refrigerant vapour during compression

(c) Compression of liquid refrigerant only

(d) Compression of water only

Q147. In an ideal vapour absorption system, the absorber pressure is equal to the pressure of

(a) Generator (b) Condenser

(c) Evaporator (d) Expansion device

Q148. If ha is enthalpy of dry air, h_v is enthalpy of water vapour and w is specific humidity, the enthalpy of moist air will be

(a) $h_a + h_v$ (b) $h_a + w\,h_v$

(c) $h_v + wh_a$ (d) $h_v + h_a/w$

Q149. A sample of moist air is at a DBT of 25 °C, WBT of 18 °C and DPT of 13 °C and corresponding saturation pressures of water vapour are 3.0 kPa, 2.0 kPa and 1.5 kPa respectively. What will be the relative humidity of air?

(a) 47% (b) 50%

(c) 65% (d) None of these

Q150. In summer air-conditioning, the room is maintained at the following conditions:

(a) 21 °C DBT, 50% RH

(b) 21 °C DBT, 60% RH

(c) 25 °C DBT, 50% RH

(d) 25 °C DBT, 60% RH

Q151. If sensible heat load and latent heat load in a building are in the ratio 3:1, sensible heat factor will be

(a) 0.67 (b) 0.33

(c) 0.75 (d) 0.25

Q152. The centre of pressure of a plane submerged surface

(a) Should coincide with centroid of surface

(b) Should coincide with centroid of pressure prism

(c) May be above or below centroid

(d) Cannot be above mentioned

Q153. Bernoulli's equation can be derived from

(a) Continuity equation

(b) Newton's law of viscosity

(c) Reynold transport theorem

(d) Euler's equation

Q154. If velocity of flow through a pipe is doubled, the head loss due to friction becomes

(a) Two times (b) Four times

(c) Eight times (d) Half

Q155. If the level of water (H) above the base point of V notch is increased by four times, the discharge through the notch will become

(a) 4 times (b) 8 times

(c) 16 times (d) 32 times

Q156. Uniform flow in a channel is characterised by

(a) The flow is uniform across the channel.

(b) The total energy remains constant along the channel.

(c) Specific energy remains constant along the channel.

(d) Total energy line either rises or falls depending on Froude number.

Q157. Of the various methods of measuring discharge through a pipe line, the one with the least loss of energy and direct reading is by

(a) Venturimeter

(b) Orifice meter

(c) Flow nozzle

(d) Traversing a pitot-static probe

Q158. A jet of water of 0.002 m^2 area moving with a velocity of 15 m/s strikes on a series of blades moving with a velocity of 6 m/s. The force exerted on the blades will be

(a) 0.18 N (b) 270 N

(c) 27 N (d) 180 N

Q159. If jet ratio of a Pelton turbine is 8, the number of buckets will be

(a) 8 (b) 23

(c) 19 (d) 31

Q160. A turbine is coupled with alternator to generate electricity. If number of pair of poles in alternator are 6 and the frequency of electricity is 50 Hz, what should be the speed of the turbine?

(a) 250 rpm (b) 500 rpm

(c) 1000 rpm (d) 3000 rpm

Q161. Following is an inward mixed flow reaction turbine:

(a) Pelton turbine (b) Francis turbine

(c) Kaplan turbine (d) None of these

Q162. In Kaplan turbine, the number of blades is generally

(a) 2 to 4 (b) 4 to 8

(c) 8 to 16 (d) 16 to 24

Q163. N.P.S.H. stands for

(a) Net Positive Supply Head

(b) Net Power Supply Head

(c) Net Positive Suction Height

(d) Net Positive Suction Head

Q164. Wet bulb depression is equal to

(a) WBT – DPT (b) DPT – WBT

(c) DBT – DPT (d) DBT – WBT

Q165. Air washer is a plant used for

(a) Cleaning air

(b) Washing air

(c) Year round air-conditioning

(d) None of these

Q166. Solid solution of carbon in gamma iron is called

(a) Austenite (b) Sorbite

(c) Troostite (d) Ferrite

Q167. The process of increasing the thickness of a bar at the expense of its length is called

(a) Drawing down (b) Setting down

(c) Upsetting (d) None of these

Q168. Welding used for production of high quality butt welds in thicker steel plates is

(a) Resistance welding

(b) Gas welding

(c) Seam welding

(d) Submerged arc welding

Q169. Following is natural defect found in timbers:

(a) Pitch (b) Heart shakes

(c) Medulla (d) Both (a) and (b)

Q170. The tool used for removing nails from wood is

(a) Screw-driver (b) Chisel

(c) Pincer (d) None of these

Q171. In gas welding, the following type of flame is used for welding brass, bronze and gold:

(a) Neutral flame

(b) Reducing flame

(c) Oxidising flame

(d) Both neutral and reducing flames

Q172. The following type of welding is used for joining rails and heavy pipes etc :

(a) Laser beam welding

(b) Resistance welding

(c) Ultrasonic welding

(d) Thermit welding

Q173. Following is not a characteristic of powder metallurgy:

(a) Complex shapes can be produced

(b) Bimetallic and laminated parts can be made

(c) Cost effectiveness

(d) Low production rates due to complex shapes

Q174. For good permeability of moulding sand, the following is not a desirable characteristics:

(a) higher percentage of silica

(b) Larger grain size

(c) Lower silt percentage

(d) Sand mixture containing grains of all sizes

Q175. The correct sequence of processes for getting smooth surface is as follows: (I – Grinding, II – Honing, III – Burnishing, IV – Buffing)

(a) I → IV → II → III (b) I → II → III → IV

(c) I → II → IV → III (d) I → IV → III → II

Q176. Following type of chip is produced while machining ductile metals with extreme pressure in cutting zone and high local temperature

(a) Continuous chip

(b) Continuous chip with built up edge

(c) Discontinuous chip

(d) Discontinuous chip with built up edge

Q177. The value of 'n' for High Speed Steel (HSS) tool in Taylor's relation VT^n = constant is in the range

(a) 0.1 to 0.15 (b) 0.2 to 0.4

(c) 0.4 to 0.6 (d) None of these

Q178. The tool used in the shaper is a

(a) Multipoint cutting tool

(b) Two point cutting tool

(c) Single point cutting tool

(d) None of these

Q179. Helix angle for most of the drills lies from

(a) 10° to 15° (b) 15° to 20°

(c) 20° to 24° (d) 24° to 30°

Q180. Select the most appropriate alternative about cutting fluids.

(a) It reduces heat generation.

(b) It wash away the chips from metal.

(c) It reduces energy consumption.

(d) All of these

ANSWER KEYS

Q1	b	**Q19**	d	**Q37**	b	**Q55**	d	**Q73**	b	**Q91**	d	**Q109**	c	**Q127**	d	**Q145**	c	**Q163**	d
Q2	d	**Q20**	a	**Q38**	c	**Q56**	a	**Q74**	c	**Q92**	a	**Q110**	a	**Q128**	d	**Q146**	b	**Q164**	d
Q3	a	**Q21**	b	**Q39**	a	**Q57**	a	**Q75**	a	**Q93**	a	**Q111**	a	**Q129**	b	**Q147**	c	**Q165**	c
Q4	c	**Q22**	d	**Q40**	a	**Q58**	c	**Q76**	b	**Q94**	b	**Q112**	b	**Q130**	c	**Q148**	b	**Q166**	a

Q5	b	**Q23**	d	**Q41**	b	**Q59**	b	**Q77**	a	**Q95**	a	**Q113**	d	**Q131**	c	**Q149**	b	**Q167**	c
Q6	a	**Q24**	d	**Q42**	c	**Q60**	b	**Q78**	d	**Q96**	d	**Q114**	b	**Q132**	a	**Q150**	d	**Q168**	d
Q7	b	**Q25**	a	**Q43**	d	**Q61**	c	**Q79**	b	**Q97**	d	**Q115**	c	**Q133**	d	**Q151**	c	**Q169**	b
Q8	d	**Q26**	a	**Q44**	b	**Q62**	b	**Q80**	b	**Q98**	b	**Q116**	c	**Q134**	d	**Q152**	d	**Q170**	c
Q9	d	**Q27**	b	**Q45**	a	**Q63**	b	**Q81**	b	**Q99**	c	**Q117**	d	**Q135**	b	**Q153**	d	**Q171**	c
Q10	a	**Q28**	a	**Q46**	c	**Q64**	b	**Q82**	a	**Q100**	c	**Q118**	c	**Q136**	c	**Q154**	b	**Q172**	d
Q11	c	**Q29**	b	**Q47**	c	**Q65**	d	**Q83**	b	**Q101**	c	**Q119**	d	**Q137**	d	**Q155**	d	**Q173**	d
Q12	d	**Q30**	b	**Q48**	c	**Q66**	b	**Q84**	b	**Q102**	a	**Q120**	b	**Q138**	c	**Q156**	c	**Q174**	d
Q13	d	**Q31**	b	**Q49**	b	**Q67**	a	**Q85**	d	**Q103**	c	**Q121**	b	**Q139**	a	**Q157**	a	**Q175**	c
Q14	a	**Q32**	c	**Q50**	d	**Q68**	c	**Q86**	a	**Q104**	c	**Q122**	b	**Q140**	d	**Q158**	b	**Q176**	b
Q15	b	**Q33**	b	**Q51**	d	**Q69**	c	**Q87**	a	**Q105**	c	**Q123**	d	**Q141**	a	**Q159**	c	**Q177**	a
Q16	a	**Q34**	c	**Q52**	a	**Q70**	d	**Q88**	b	**Q106**	b	**Q124**	d	**Q142**	b	**Q160**	c	**Q178**	c
Q17	b	**Q35**	c	**Q53**	d	**Q71**	c	**Q89**	d	**Q107**	c	**Q125**	b	**Q143**	d	**Q161**	b	**Q179**	d
Q18	a	**Q36**	d	**Q54**	b	**Q72**	a	**Q90**	d	**Q108**	d	**Q126**	d	**Q144**	d	**Q162**	b	**Q180**	d

SOLUTIONS

Q1. Solution (b): Here's the Mayer's formula.

$C_P - C_V = R/J$ (For one gm mole of the gas) where C_P = Specific heat at constant volume; $C_V =$ Specific heat at constant pressure R = Universal gas constant; $J =$ Molecular weight of the gas

Q2. Solution (d): Efficiency of Carnot engine or Reversible engine

$$\eta_c = 1 - \frac{T_{sink}}{T_{source}}$$

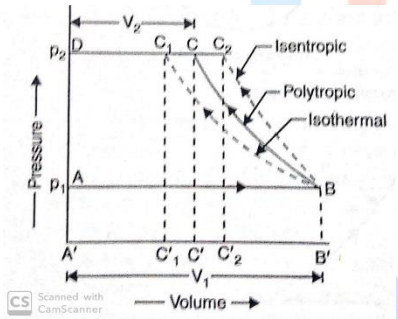
Efficiency of Carnot engine or Reversible is just depends on the temperature of source and sink.

Q3. Solution (a): The second law of thermodynamics states that the total entropy of an isolated system (the thermal energy per unit temperature that is unavailable for doing useful work) can never decrease.

$$dS = \frac{\delta Q}{T}$$

Q4. Solution (c): Internal energy is the function of temperature, as we know that temperature remains constant during isothermal process. Hence internal energy remains constant during isothermal process.

Q5. Solution (b):



From the figure it is clear that maximum work is done in adiabatic or isentropic process.

Q6. Solution (a):

Here

$T_1 = 327°C = 600\ K$

$T_2 = 27°C = 300\ K$

$V_2 = 1.5\ m^3$

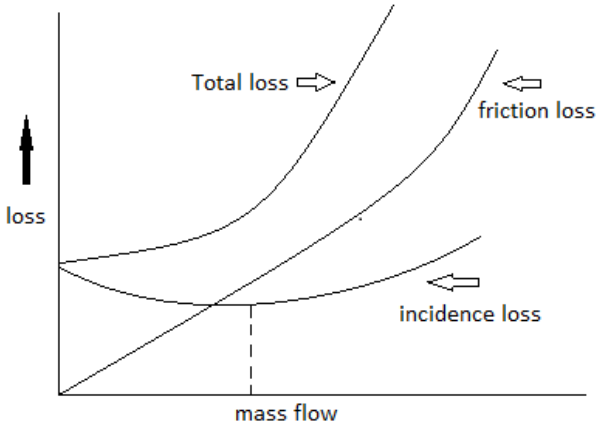
Using Relation $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{V_1}{600} = \frac{1.5}{300}$

$V_1 = 3m^3$

Q7. Solution (b): Reciprocating air compressor is a positive displacement air compressor in which air is sucked in a chamber and compressed with the help of a reciprocating piston. The reciprocating air compressors are found in places where low flow rate and high pressure of the gas are required.

Q8. Solution (d): Frictional losses: A major portion of the losses is due to fluid friction in stationary and rotating blade passages. **Incidence losses**: During the off-design conditions, the direction of relative velocity of fluid at inlet does not match with the inlet blade angle and therefore fluid cannot enter the blade passage smoothly by gliding along the blade surface. The loss in energy that takes place because of this is known as incidence loss. This is sometimes referred to as shock losses. **Clearance and leakage losses**: Certain minimum clearances are necessary between the impeller shaft and the casing and between the outlet periphery of the impeller eye and the casing.



Q9. Solution (d): Bell-Coleman cycle is used in air refrigeration system and compressed air is

selected as the refrigerant in this cycle because air is used as refrigerant is safe and it won't do any harm and no damage to atmosphere.

Q10. Solution (a): In terms of tones of refrigeration amount of refrigerant effect develop by melting of one tonne of ice in 24 hours.

One tonnes of refrigeration = 1TR = 14017 kJ/hr

1 TR = 210 kJ/min

1TR = 3.5 kJ/sec or kW

Q11. Solution (c): Properties of Refrigerant:

1. Refrigerant must have low specific heat and high latent heat. Because high specific heat decreases the refrigerating effect per kg of refrigerant and high latent heat at low temperature increases the refrigerating effect per kg of refrigerant.

2. Saturation pressure should be above or equal to the atmospheric pressure.

3. Refrigerant should be chemically stable.

4. It should not be non-flammable.

5. It should be non-toxic.

6. It have good thermal conductivity.

7. Eco-friendly.

Q12. Solution (d): Given

$T_1 = 27℃ + 273 = 300$ K

$T_2 = -23℃ + 273 = 250$ K

Carnot COP of heat pump

$COP_{H.P(carnot)} = \frac{T_1}{T_1 - T_2} = \frac{300}{300-250} = 6$

Q13. Solution (d):

Refrigerant no	**Name**	**Freezing point(℃)**
R-12	Dichlorodifluoromethane	-157
R-22	Difluoromonochloromethane	-160
R-717	Ammonia	-77.73
R-744	Carbon-dioxide	-56.67

Q14. Solution (a): Relative humidity $(\emptyset)$:Relative humidity is the measure of water vapour absorbing capacity.

$$\emptyset = \frac{m_v}{m_s} = \frac{P_v}{P_s}$$

m_v = mass of vapour

m_s = mass of vapour in saturated condition at same volume and teamperature

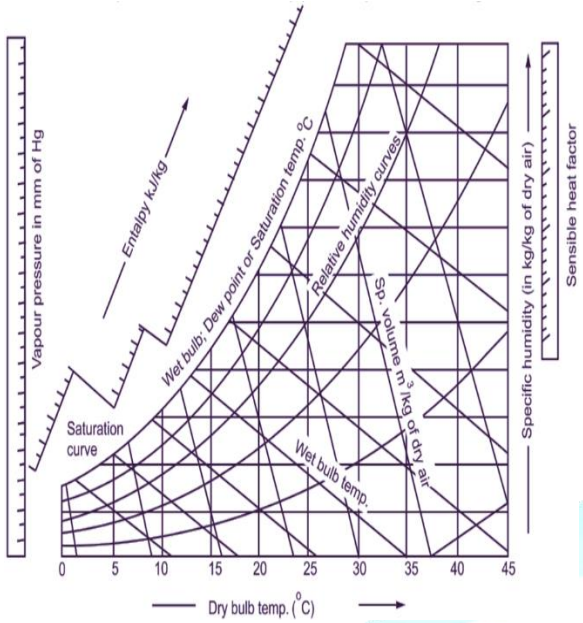
P_v = partial pressure of vapour

P_s = partial pressure of vapour in saturated condition

Relative humidity of saturated air will be 100%.

Q15. Solution (b): The temperature measured by wick-covered bulb of a thermometer is called wet bulb temperature. It represent the amount of moisture in the air.

Q16. Solution (a): As relative humidity decreases, the dew point will be lower than wet bulb temperature. This can be seen in the below diagram



Q17. Solution (b): Sensible heat is the energy required to change the temperature of a substance with no phase change.

Latent heat is the energy absorbed by or released from a substance during a phase change from a gas to a liquid or a solid or vice versa.

Q18. Solution (a): S.I unit of entropy is J. K^{-1} but according to question option (a) is correct.

Q19. Solution (d):

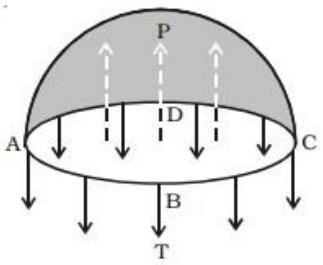


Fig. Excess pressure inside a liquid drop

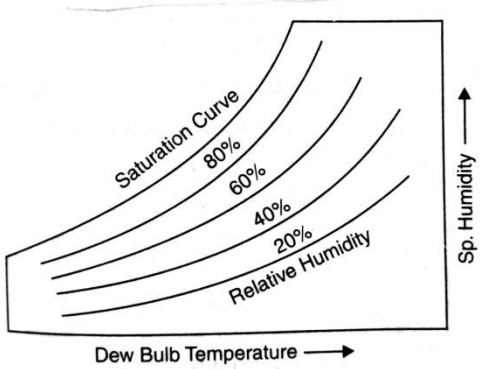
If T is the surface tension of the liquid, the force due to surface tension acting downward along the circumference of the circle ABCD is T 2πr. At equilibrium, $P\pi r^2 = T\,2\pi r$

$P = 2T/r$

Q20. Solution (a): Newton's law of viscosity defines, the shear stress between adjacent fluid layers is proportional to the velocity gradient between the two layers.

$$\tau \propto \frac{d\theta}{dt} \propto \frac{du}{dy}$$

Q21. Solution (b):



Q22. Solution (d): Weber number: It is the ratio of inertia force to surface tension.

$$Wb. = \frac{\rho_g v_g^2 d_0}{\sigma_m}$$

Q23. Solution (d): We know that

For laminar flow, $Friction\ factor, f = \frac{64}{R_e}$

Further, $R_e = \frac{\rho v d}{\mu}$

Therefore, The friction factor (f) depends on the velocity of flow, fluid density, pipe diameter and the viscosity of the pipe. Roughness of the pipe is also an important criterion to determine the friction factor.

Q24. Solution (d): Pelton wheel turbine is generally used for high head and low specific speed. It is a impulse turbine.

Q25. Solution (a): Here's the relation for the hydraulic efficiency of Pelton turbine

$$\eta_{hyd} = \frac{2(V_1 - u)(1 + \cos\emptyset)u}{V_1^2}$$

Condition of maximum hydraulic efficiency is that blade velocity is half that of the jet velocity.

$u = \frac{V}{2}$

Hence; $\eta_{max} = \frac{1+\cos\alpha}{2}$

Where α = vane angle at outlet

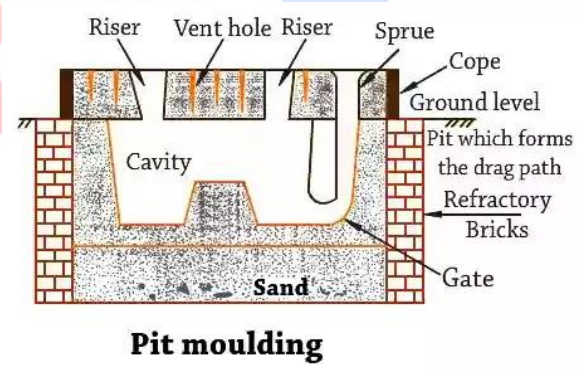
Q26. Solution (a): Brazing is a joining process traditionally applied to metals (but also to ceramics) in which molten filler metal (the braze alloy) flows into the joint.

The melting point of the filler metal is above 450°C, but always below the melting temperature of the parts to be joined. Borax is used as flux in Brazing.

Q27. Solution (b): Moulding sand is defined as granular particles resulting from the breakdown of rocks, due to the action of natural forces, such as frost, wind, rain, heat and water currents. Rocks have a complex composition and sand contains most of the elements of the rocks. The principal constituents of moulding sands are as follows: Silica (SiO2)—86 to 90%, Alumina (Al2O3)—4 to 8%, Iron oxide (Fe2O3)—2 to 5% with smaller amounts of the oxides of Ti. MnCa, and some alkaline compounds Moulding sands are graded according to their clay content and grain size Sand is of mainly two types: Natural sand and synthetic sand.

Q28. Solution (a): A hot tear is a discontinuity that occurs during the solidification stage of a casting operation. It can occur because as a material solidifies, it will generally want to contract.

Q29. Solution (b): Usually large castings are made in pits instead of drag flasks because of their huge size. In pit molding, the sand under the pattern is rammed by bedding-in process. The walls and the bottom of the pit are usually reinforced with concrete and a layer of coke is laid on the bottom of the pit to enable easy escape of gas. The coke bed is connected to atmosphere through vent pipes which provide an outlet to the gases. One box is generally required to complete the mold, runner, sprue, pouring basin and gates are cut in it.



Pit moulding

Q30. Solution (b): Metal Inert Gas (MIG) welding is an arc welding process

1. arc is generated between consumable electrode and workpiece.
2. Electrode is in the form of small diameter wire which is continuously feed by servo mechanism.
3. Weld pool is protected by shielded Inert gas.
4. D.C or A.C supply can be used.

Application: Welding of Al, Mg, Cu and its alloys used in automobiles industry, aerospace and spacecraft industries.

Q31. Solution (b): In DC welding no fluctuation of power occur and polarity is fixed while in AC welding polarity is not fixed. Therefore, arc stability is better with DC welding.

Q32. Solution (c): Lap joint is the recommended because the area of overlap in this joint is kept large, which makes the joint stronger.

Q33. Solution (b): Forming operations are those in which the shape of a metal piece is changed by plastic deformation; for example, forging, rolling, extrusion, and drawing are common forming techniques. Plasticity is defined as the mechanical property of a material that retains the deformation produced under load permanently.

Q34. Solution (c): The solidification time of a casting is a function of the volume of a casting and its surface area.

Chvorinov's Rule

Solidification time = $k\left(\frac{V}{A}\right)^2$

For Sphere: $\frac{V}{A}=\frac{D}{6}$ (where D is diameter of sphere)

For Cube: $\frac{V}{A}=\frac{a}{6}$ (where a is side of cube)

Q35. Solution (c): Spinning is a sheet metal forming process in which a metal blank is pressed over a rotating chuck or form mandrel with the help pressing tool to obtain axisymmetric hollow shell any heavy duty lathe with adequate speed range can be used for spinning process. However, special spinning machines have also been designed fitted with a ball-bearing centre, a tool rest with movable steel pins and a rotating chuck made of hard wood.

Q36. Solution (d): Burnishing is the newest method of gear finishing. It is cold working process accomplished by rolling the gear in contact and under pressure with three hardened burnishing gears.

Q37. Solution (b): Work hardening is the strengthening of a metal by plastic deformation. This strengthening occurs because of dislocation movements and dislocation generation within the crystal structure of the material. Due to strain hardening, yield strength increases and ductility decreases.

Q38. Solution (c): Cast iron has a very high damping property that's why it is used for making lathe bed.

Q39. Solution (a): Blanking is a process in which the punch removes a portion of material from the larger piece or a strip of sheet metal. In this process small removed piece is the useful part and the rest is scrap.

Q40. Solution (a): The sequence of parameters affecting tool life is:

Cutting speed > Feed > Depth of cut

Q41. Solution (b): Flank wear is due to work hardening. It occurs at the tool flanks, where it contacts with the finished surface, as a result of abrasion and adhesion wear.

The crater wear is mainly due to diffusion and abrasion. For the crater wear the, the temperature is the main culprit and tool diffuses into the chip material and the tool temperature is maximum at some distance from the tooltip.

Q42. Solution (c): The hot continuous chip becomes hard and brittle at a distance from its origin due to work hardening and cooling. If the running chip does not become enough curled and work hardened, it may not break. In that case the running chip is forced to bend or closely curl so that it breaks into pieces at regular intervals

Q43. Solution (d): No cutting fluid is normally used while machining cast iron because of the self-lubricating property of graphite present in cast iron. Lubrication in cast iron is dry or compressed air.

Q44. Solution (b): Copper can be drawn into wire due to its high ductility.

Q45. Solution (a): Silver solder contains: 65% fine silver. 20% copper. 15% zinc.

Q46. Solution (c): Muntz metal, also called Yellow Metal, variety of the alloy brass consisting of 60 percent copper and 40 percent zinc.

Q47. Solution (c): In electro discharge machining the tool is made of cast iron, brass, copper and copper tungsten alloy. The electro discharge machining can machine hardest materials and produces high degree of surface finish. In EDM process the work piece is connected to Anode and the electrode connected to the cathode.

Q48. Solution (c): The cutting tool used in the spark erosion machining process is called Arc.

Q49. Solution (b):.Anvil is made of cast steel.

Q50. Solution (d): Discrete manufacturing is an industry term for the manufacturing of finished products that are distinct items capable of being easily counted, touched or seen. Discrete manufacturing involves parts and systems like nuts and bolts, brackets, wires, assemblies and individual products.

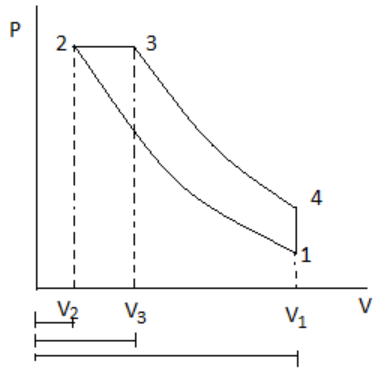
Q51. Solution (d): Examples of continuous products: Metal Sheets, Pipes, Wire Rolls, Power plant, Chemical plant.

Q52. Solution (a): A furnace grate is provided in a steam boiler furnace for supporting the solid fuel in the furnace. Grate is so designed that it can also allow air to admit air in the solid fuel for combustion.

Q53. Solution (d): Boiler rating is the heating capacity of a steam boiler; it is expressed in BTU per hour (BTU/h), horsepower (hp), or pounds of steam per hour.

When a boiler operates at its maximum rated capacity, it is referred to as maximum load. If the load varies from hour to hour, it operates at a varying load.

Q54. Solution (b): Diesel Cycle



1-2 isentropic compression

2-3 constant pressure heat addition

3-4 isentropic expansion

4-1 constant volume heat rejection

Compression ratio = $\frac{V_1}{V_2}$

Cut off ratio (ρ)

$\rho = \frac{V_3}{V_2} \therefore \rho > 1$

Efficeincy of diesel cycle

$\eta_{th} = 1 - \frac{1}{r^{\gamma-1}}\left[\frac{\rho^r - 1}{(\rho-1)\gamma}\right]$

Expansion ratio = $\frac{r}{\rho}$

$\frac{V_4}{V_3} = \frac{V_1}{V_3}$

We can clearly see by the above relation that efficiency of diesel cycle decreases with increase in cut off ratio.

Q55. Solution (d): An ideal fuel/air mixture in which both the fuel and the oxygen in the air are completely consumed is called stoichiometric mixture. Such a mixture doesn't cause knocking. It is directly dependent on number of hydrogen atoms per a carbon molecule in a fuel. For petrol air fuel ratio by mass is 14.7:1.For CI engines it vary from 18:1 to 80:1 from full load to no load.

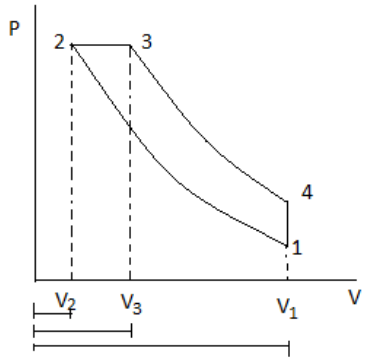
Q56. Solution (a): In the magneto ignition system, engine speed is directly proportional to current rate, so, as the engine speed increases the flow of current increases. The magneto is best at high speeds and therefore is widely used for sports and racing cars, aircraft engines.

Q57. Solution (a): Decreasing the intake air temperature leads to increase in volumetric efficiency due to increase the density of intake air, as a result more air volume draws into the cylinder to the cylinder's swept volume.

Q58. Solution (c): In the regeneration process, there is reduction in heat supplied to the gas but there is no effect on the turbine and compressor work. Therefore, the regeneration will not increase the work ratio in the turbine but the efficiency of the turbine increases in the regeneration process.

Q59. Solution (b): Priming is the carryover of varying amounts of droplets of water in the steam (foam and mist), which lowers the energy efficiency of the steam and leads to the deposit of salt crystals on the super heaters and in the turbines.

Q60. Solution (b):



Compression ratio of an IC engine is the ratio of total cylinder volume to clearance volume.

$$r = \frac{V_1}{V_2}$$

$$r > 1$$

$$r = \frac{V_C + V_S}{V_C}$$

Q61. Solution (c): We know that

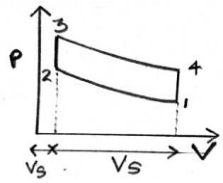
$$Octane\ number \propto \frac{1}{Cetane\ number}$$

And

$$Cetane\ number \propto \frac{1}{Ignition\ delay}$$

$$Octane\ number \propto Ignition\ delay$$

Q62. Solution (b): Thermal Efficiency or Air standard Efficiency of Otto cycle



$$\eta_{th} = 1 - \left(\frac{T_1}{T_2}\right)$$

$$\eta_{th} = 1 - \frac{1}{r^{\gamma-1}} \therefore \frac{T_1}{T_2} = \frac{1}{r^{\gamma-1}}$$

Here r = compression ratio.

Q63. Solution (b): Viscosity is the most important physical property of the oil. It measures the internal resistance of a fluid as one layer moved, in relation to another layer. The oil should be viscous enough to maintain a fluid film between the moving parts or sliding surface or bearing and its journal.

Q64. Solution (b): Capillary tube is a simple copper tube having very less diameter in few millimeter and longer length in terms of few feet. This low diameter and higher length increase friction and this is the reason why high-pressure liquid refrigerant is converted to low-pressure one due to pressure drop in capillary itself.

Q65. Solution (d): Domestic refrigerator operates on Vapour compression cycle. The vapor compression cycle consists of 'Evaporator', 'Compressor', 'and Condenser 'and' Capillary tube' as main parts. The system works on closed cyclic operation with the help of 'refrigerant'. This refrigerant changes the phase during passing through evaporator and condenser to exchange the heat.

Q66. Solution (b): The lithium bromide absorption refrigeration system uses a solution of lithium bromide in water. Water is being used as refrigerant whereas Li-Br is a highly hydroscopic salt, used as absorbent. The Li-Br solution has a strong affinity for water vapour because of its very low vapour pressure.

Q67. Solution (a): It is a temperature on which water vapor just start condensing or it is a saturation temperature which vary with the partial pressure of vapor.When the dew point equals the air temperature, the air is saturated and the relative humidity is 100%.

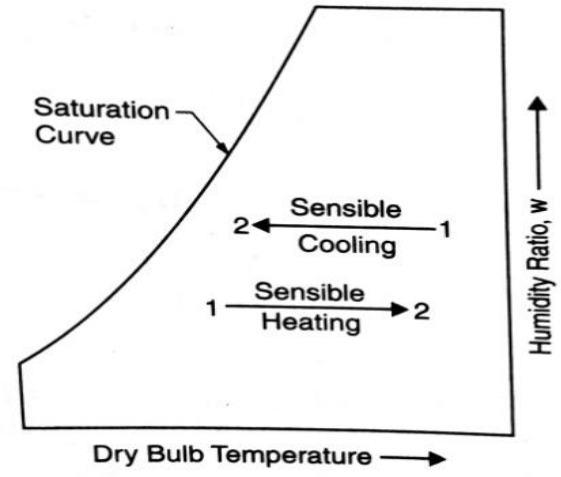
Keypoints

For unsaturated air : DBT>WBT>DPT

For saturated air : DBT=WBT=DPT

Q68. Solution (c): Sensible heating:

The heating of air without any change in moisture content.



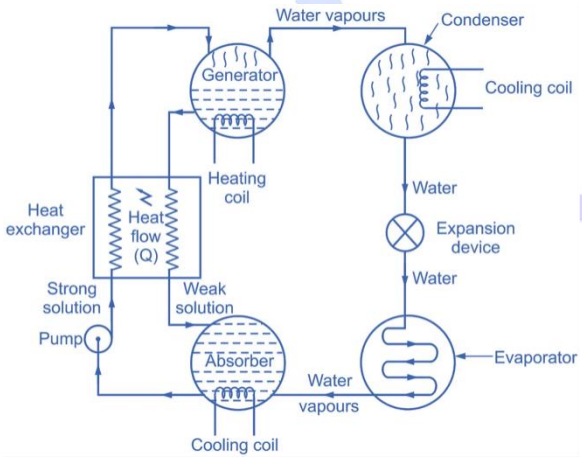
Relative humidity $(\emptyset) = \text{decrease}$

$$\text{DBT} = \text{Increase}$$

Specific humidity $(\omega) = \text{constant}$

Q69. Solution (c): A psychrometer measures humidity by taking both a wet-bulb and a dry-bulb temperature reading. With those two values known, the other properties of the air, including its moisture content, can be determined by computation or by reading a psychrometric chart.

Q70. Solution (d):



Q71. Solution (c): Given

$COP_{(h.p)} = 4$

Work input = 1 kW

We know that

$COP_{(h.p)} = 1 + COP_{(ref)}$

$COP_{ref} = 1-4$

$COP_{ref} = 3$

Q72. Solution (a): When chlorine and bromine atoms come into contact with ozone in the stratosphere, they destroy ozone molecules. One chlorine atom can destroy over 100,000 ozone molecules before it is removed from the stratosphere. Ozone can be destroyed more quickly than it is naturally created.

Q73. Solution (b): Bernoulli's equation expresses conservation of energy for flowing fluids (specifically incompressible fluids), such as water. It shows the equivalence of the overall energy for a given volume of a fluid as it moves Bernoulli's Theorem: " For a steady, ideal flow of an incompressible fluid, the total energy which consists of pressure energy, kinetic energy and datum energy, at any point of the fluid is constant".

$$\frac{p}{\rho g} + \frac{v^2}{2g} + z = \text{constant}$$

Here;

$\frac{p}{\rho g}$ = pressure energy per unit weight of fluid or pressure head

$\frac{v^2}{2g}$ = kinetic energy per unit weight or kinetic head

z = potential energy per unit weight or potential head

Q74. Solution (c): Raindrops take up the spherical shape due to the surface tension of water which is caused due to the tendency of water molecules to stick together. The spherical shape is having the least possible surface area due to which it can

resist any of the external force in the atmosphere.

Q75. Solution (a): We know that

$Specific\ gravity, SG = \frac{\rho_{fluid}}{\rho_{standard\ fluid}}$

$\rho_{fluid} = \rho_{standard\ fluid} \times SG$

$\rho_{fluid} = 1000 \times 1.3 = 1300$ kg/m^3

So $Pressure, P = \rho_{fluid} gh$

$P = 1300 \times 9.81 \times 5 = 63765\ Pa$

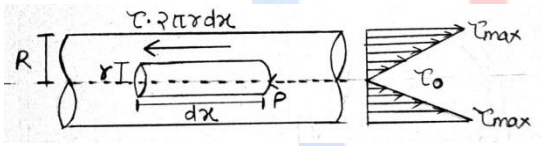
Q76. Solution (b): From continuity equation

$A_1 \times V_1 = A_2 \times V_2$

Or $V \propto \frac{1}{A}$

Since in diverging section area increases. So the velocity will decrease.

Q77. Solution (a): Shear stress distribution for laminar flow



$\tau = -\frac{r}{2}\left(\frac{\partial P}{\partial x}\right)$

So $\tau \propto r$

$\frac{\tau_{max}}{\tau} = \frac{R}{r}$

As per given in the question

D = 20cm or R=10 cm

r = 5 cm

$\frac{\tau_{max}}{20} = \frac{10}{5}$

$\tau_{max} = 40\ MPa$

Q78. Solution (d): Velocity ratio is defined as the ratio of tangential velocity of vane tip to $\sqrt{2\ g\ H_{net}}$.

For Pelton turbines, it is in the range of 0.45 to 0.5.

For Francis turbine it varies from i.e. 0.6 to 0.9.

For Kaplan turbines, it is in the range of 1.4 to 2.

Q79. Solution (b): Unlike reaction water turbines, Pelton turbines require no draft tube because they operate in a pressure-less environment. These can be horizontally or vertically oriented a draft tube is generally not used since the runner operates under approximately atmospheric pressure and the head represented by the elevation of the unit above tail, water cannot be utilized.

Q80. Solution (b): The vanes of centrifugal pumps are curved backward to prevent overloading of the impeller motor.

BLADES

$\emptyset < 90^0\ backward\ vane\ or\ blade$

$\emptyset = 90^0\ Radial\ blade$

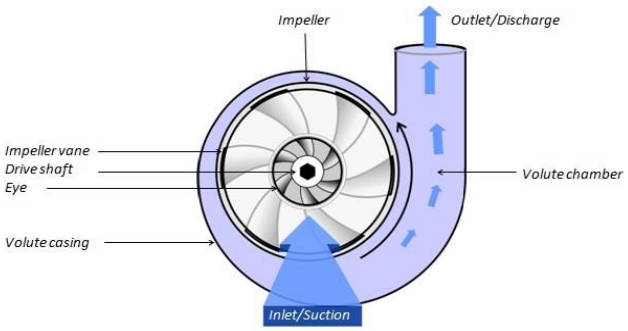
$\emptyset > 90^0\ Forward\ vane$

Q81. Solution (b): A Notch is a device used for measuring the rate of flow of a liquid through a small channel or a tank. It may be defined as an opening in the side of a tank or vessel such as liquid surface in the tank is below the level of opening. ... The discharge over notch is measured by measuring the head acting over the notch.

Q82. Solution (a): A centrifugal pump is a mechanical device designed to move a fluid by means of the transfer of rotational energy from one or more driven rotors, called impellers. Fluid enters the rapidly rotating impeller along its axis and is cast out by centrifugal force along its

circumference through the impeller's vane tips. The action of the impeller increases the fluid's velocity and pressure and also directs it towards the pump outlet.

The pump casing is specially designed to constrict the fluid from the pump inlet, direct it into the impeller and then slow and control the fluid before discharge.



Fluid enters the impeller at its axis (the 'eye') and exits along the circumference between the vanes.

Q83. Solution (b): Francis turbine is a medium head turbine and they are used generally for medium head application (60 to 250 m).

Q84. Solution (b): Several different processes such as extrusion, casting, cold rolling and drawing may be used, but roll forming is the most common method of sheet production of copper.

Q85. Solution (d): Drawing dies are typically made of tool steel, tungsten carbide, or diamond, with tungsten carbide and manufactured diamond being the most common.

Q86. Solution (a): The most commonly used welding methods for automotive applications are resistance spot welding, resistance seam welding, metal inert gas (GMAW) welding, tungsten inert gas (GTAW) welding as also laser beam welding (LBW), friction welding (FW), and plasma arc welding (PAW).

Q87. Solution (a): The neutral flame has a one-to-one ratio of acetylene and oxygen. It obtains additional oxygen from the air and provides complete combustion.

Q88. Solution (b): Greensand should not stick to the pattern. Cope and drag boxes should be separated and traced easily. Parting sand helps in these. It is clay free silica sand. It is also used as parting dust.

Q89. Solution (d): Sprue is a connecting passage between pouring basin and runner for molten metal in the tapered form to avoid the aspiration effect so that pressure equally maintained in the column of liquid metal streaming to the mould.

Q90. Solution (d): Main purposes of cutting fluids are to cool and lubricate machining region as well as to flush away the chips produced.

Q91. Solution (d): In threading, spindle speed and threading feed rate are always kept minimum.

Q92. Solution (a): In the Shaper machine a single point cutting tool is rigidly mounted on the tool holder, which is mounted on the ram. The work piece is held rigidly in a vice (or clamped directly on the table).The ram reciprocates and thus cutting tool held in tool holder moves backward and forward on the work piece. The size of a shaper is specified by the maximum length of stroke or cut it can make. In a shaper machine work piece is held stationary and the cutting tool

moves back and forth across the work and workpiececuts during forward stroke.

Q93. Solution (a): Boring is a machining process uses a specially designed cutting tool like a drill bit to enlarge a hole that is already in the part to improve the accuracy.

Q94. Solution (b): Sodium silicate is used as binding material for grinding wheels.

Q95. Solution (a): Drill is made from a round bar of tool material, and has three principles parts: the point, the body and the shank. The drill is held and rotated by its shank. The point comprises the cutting elements while the body guides the drill in the operation.

Point: The point is the cone shaped end and it does the cutting. It consists of the following:

i. **Dead center:** It is the sharp edge at the extreme tip of the drill. This should always be the exact center of the drill.

ii. **Lips:** these are the cutting edges of the drill.

iii**. Heel:** It is the portion of the point back from the cutting edge.

Q96. Solution (d): Natural abrasives are:

i. Corrundum

ii. Diamond

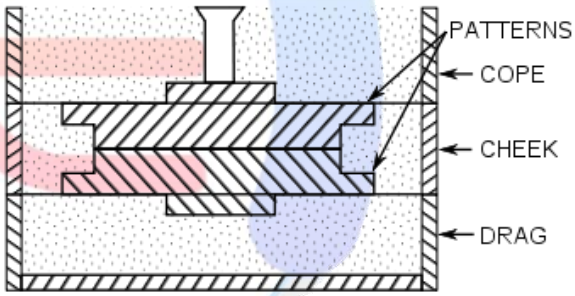
iii. Emery

Q97. Solution (d): Cutting speed of different metals

$V_{CI} < V_{steel} < V_{Brass} < V_{Copper} < V_{Al}$

Q98. Solution (b): The main purpose of the flux is to prepare the metal surfaces for soldering by cleaning and removing any oxides and impurities. Oxides are formed when metal is exposed to air and may prevent the formation of good solder joints.

Q99. Solution (c):



Q100. Solution (c): Shrinkage of different materials

Bismuth – Negligible.

White metal (Tin) – 5 mm/m.

Cast Iron – 10 mm/m.

Aluminum – 13 mm/m.

Brass – 15 mm/m.

Copper – 17 mm/m.

Steel – 20 mm/m.

Zinc – 24 mm/m

Q101. Solution (c): The knee is a rigid grey cast iron casting which slides up and down on the vertical ways of the column face. An elevating

screw mounted on the base is used to adjust the height of the knee and it also supports the knee.

Q102. Solution (a): Seasoning is the process of drying timber to remove the bound moisture contained in walls of the wood cells to produce seasoned timber.

Q103. Solution (c): Teak wood is known as hardest wood in India.

Q104. Solution (c): Dynamic viscosity is directly proportional to the shear stress and is expressed by the symbol (mu, symbol for dynamic viscosity) and has the SI units of N s/m2 (Newton second per square meter).

Q105. Solution (c): From mass conservation

$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$

Q106. Solution (b): Two-stroke engines are a much simpler design, making them easier to fix. They do not have valves, but rather ports.

Q107. Solution (c):

Cycles	Compression Ratior (Range of r)
Otto cycle	9-10 or less than 12
Dual cycle	12 to 16
Diesel cycle	16 to 20

Q108. Solution (d): The methods used for governing the steam turbines are:

1. Throttle Governing
2. Nozzle-Control Governing
3. By-Pass Governing's
4. Extraction Pressure Regulating System
5. Over-Speed Tripping System/Emergency Governor.

Q109. Solution (c): Reaction Turbine (Parson Turbine)

In a reaction turbine there are fixed and moving blade, here fixed blade act as a nozzle which decrease the pressure and kinetic energy. It's degree of reaction is 0.5.

Q110. Solution (a): Boiler mountings are safety device installed for the safe operation of a boiler. ... These equipment save the boiler from damage due to extreme pressure, steam back flow, shell collapse due to vacuum, unregulated steam pressure, low water level, back flow of feed water to the pump and dry running respectively.

Q111. Solution (a): Babcock And Wilcox Boiler is a stationary water tube boiler. It consists of the steam-water drum. a short tube connects the steam water drum with the uptake header and down header.

Specifications of Babcock-Wilcox boiler Horizontal water drum, Low pressure (11.5-17.5bar), Evaporating capacity(20K-40K kg/hr), Natural circulation, Stationary, Inclined (5-15edge) Steel tube (Zigzag), Brick work, Efficiency=60-80%, Size of water tubes= 6cm to 9cm, Dia of drum=1.2m to 1.8m ,Length of drum=6m to 9m

Q112. Solution (b): In all modern power plants, high-pressure boilers (> 80 bar) are used widely.

Q113. Solution (d): Dry ice is solid carbon dioxide used in packing frozen items.

Q114. Solution (b): Pitot Tube is a device used for calculating the velocity of flow at any point in a pipe or a channel.

Q115. Solution (c): For Flat plate

Laminar – $Re \leq 5 \times 10^5$

Transitional $-5 \times 10^5 < Re < 5 \times 10^5$

Turbulent – Re > 5 $\times 10^5$

Q116. Solution (c): Capillary action occurs due to cohesive force between liquid particles.

Q117. Solution (d): Cavitation:- If a pressure on a pipe goes below or equal to vapor pressure of liquid, then boiling will starts and the bubble get collapse on pipe surface due to which pipe surface will start eroding and cavity will form. It is due to lower suction pressure.

Q118. Solution (c): $\left(\frac{P}{D^5N^3}\right)_m = \left(\frac{P}{D^5N^3}\right)_P$

$D = \text{Outer diameter of impeller}$

$P = \text{Shaft power}$

$H_m = \text{Manometric head}$

$N = \text{Impeller speed in rpm}$

Q119. Solution (d): Favorable conditions for continuous chips are

i. Ductile workpiece

ii. High speed

iii. Low feed rate

iv. Low depth of cutting

v. High back rake angle.

vi. Less friction between tool face and chip

Q120. Solution (b): Thermit Welding:

1. Thermit mixture can be heated in a crucible upto 1200°C using Mg rod and crackers.

2. At this temperature due to thermit reaction heat will be produced & iron is separated

3. Al_2O_3 will be acting as a slag. Thermit reaction

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe + \Delta h$$

Application: Repair works of railway rails,Joining of high thickness plates and broken castings.

Q121. Solution (b): Grey cast iron is welded by gas welding. Gray cast iron has low ductility and therefore will not expand or stretch to any considerable extent before breaking or cracking. It has acceptable ductility, tensile strength, yield strength, and impact resistance for most applications. Grey Iron is also excellent in its ability to dampen vibrations making it ideal for machinery bases and as well as many housing applications.

Q122. Solution (b): Metal Stamping is a manufacturing process used to convert flat metal sheets into specific shapes. It is a complex process that can include a number of metal forming techniques — blanking, punching, bending and piercing, to name a few.

Q123. Solution (d): Wood is the most popular and commonly used material for pattern making. The main varieties of woods used in pattern-making are shisham, kail, deodar, teak and mahogany.

Q124. Solution (d): Properties of moulding sand:

Cohesiveness

The ability of the sand particles to stick with each other is called cohesiveness.

Porosity or Permeability:

It is the ability of sand by which it allows the gases to pass through it easily.

Flowability

The ability of moulding sand to behave like a fluid when it is rammed is called flowability.

Collapsibility

The ability of the moulding sand to collapse after solidification of the molten metal is called collapsibility.

Q125. Solution (b): Soldering is a joining process used to join different types of metals together by melting solder. Solder is a metal alloy usually made of tin and lead which is melted using a hot iron. The iron is heated to temperatures above 600 degrees °F which then cools to create a strong electrical bond.

Q126. Solution (d): Buffing is defined as a finishing process that involves the use of a loose abrasive on a wheel. To polish a workpiece, a manufacturing company may use a wheel that's covered with an abrasive disc

Q127. Solution (d): The depth of cut depends on the amount of metal to be removed, tool material, and the power and rigidity of the machine tool.

Q128. Solution (d): The *thermocouple* converts temperature to a small DC voltage or current. It consists of two dissimilar metal wires in intimate contact in two or more junctions. The output voltage varies linearly with the temperature difference between the junctions—the higher the temperature difference, the higher the voltage output.

Q129. Solution (b): An inert shielding gas such as argon, helium or a mixture of both is used to shield the tungsten electrode and the weld pool from oxidation. Hence, the process is also referred to as tungsten inert gas welding.

Q130. Solution (c): Chemical formulae for R-12: Dichlorodifluoromethane (CCl_2F_2).

Q131. Solution (c): Function of regenerator in gas turbine

i. Turbine work constant.

ii. Compressor work constant.

iii. Net work constant.

iv. Heat input increases.

v. Efficiency increases.

Q132. Solution (a): The bottom ring is responsible for most of the oil control, helping to make sure the right amount of oil is used to lubricate the working surfaces of the cylinder, while the intermediate ring helps with both functions, playing a finishing role in the combustion sealing as well as the downward oil scraping.

Q133. Solution (d): A fly cutter is a single-point rotary cutting tool primarily used on a milling machine for machining large and flat surfaces.

Q134. Solution (d): Venturi Meter is mainly used to estimate the rate of flow of liquid through a pipe by decreasing the cross-sectional area and creating a gradient of pressure.

An Orifice Meter is basically a type of flow meter

used to measure the rate of flow of Liquid or Gas, especially Steam, using the Differential Pressure Measurement principle.

The pressure loss in venturi meter is 10% while in the orifice meter the pressure loss is 50-60%.

Q135. Solution (b): A Pump is a mechanical device that uses to transfer different fluids from one location to another.It is a hydraulic device that lifts fluids from low to high levels, moves fluids from low to high-pressure areas. The pump transfers fluid by converting the fluid's mechanical energy into pressure energy (hydraulic energy).

Q136. Solution (c): Specifications of Cochran Boiler:

Evaporating Capacity (3600Kg/hr), Low pressure (15bar), Vertical, Natural circulation, Hemispherical Top, Diameter 2.75m, Height 5.79m, Efficiency 70%

Q137. Solution (d): The plug is made up of tin or leads alloy, which has a low melting point. The function of the fusible plug is to put-off the fire in the furnace of the boiler when the water level falls below an unsafe level and thus avoids the explosion, which may take place due to overheating of the tubes and the shell. It is fitted over the crown of the furnace or the combustion chamber.

Q138. Solution (c): Given

$T_{min} = 300\ K$

$T_{max} = 1200\ K$

We know that for maximum work output

$$r_p = \left(\frac{T_{max}}{T_{min}}\right)^{\gamma/2(\gamma-1)}$$

Or $\eta_{max} = 1 - \frac{1}{(r_p)^{\gamma-1/\gamma}}$

$$\eta_{max} = 1 - \sqrt{\frac{T_{min}}{T_{max}}}$$

$$\eta_{max} = 1 - \sqrt{\frac{300}{1200}} = 1 - \frac{1}{2}$$

$$\eta_{max} = 0.5 = 50\%$$

Q139. Solution (a): Given

$V_c = 100\ m^3$

$V_T = 400\ m^3$

$V_s = 300\ m^3$

$$r = \frac{V_c + V_s}{V_c}$$

$$r = \frac{100 + 300}{100} = \frac{400}{100} = 4$$

$$\eta_{th} = 1 - \frac{1}{r^{\gamma-1}} = 1 - \frac{1}{(4)^{1.5-1}}$$

$$\eta_{th} = 1 - \frac{1}{2} = 0.5$$

$$\eta_{th} = 50\%$$

Q140. Solution (d): The piston is attached to the connecting rod (or piston rod) by a short hollow tube called a wrist pin, or gudgeon pin. This wrist pin carries the full force of combustion. The piston is not only subject to vertical forces during combustion, but also side forces caused by the continuously changing angle of the connecting rod.

Q141. Solution (a): The process of admitting air and expelling exhaust gas is known as scavenging. The three main types of scavenging for two stroke engines are cross flow, uniflow and loop flow.

Q142. Solution (b): Degree of Reaction

$$\text{Degree of Reaction} = \frac{\text{Pressure rise in rotor blade}}{\text{Pressure rise in compressor}}$$

$$\text{Degree of Reaction} = \frac{\text{Static enthalpy drop}}{\text{Stagination enthalpy drop}}$$

$$\text{Degree of Reaction} = \frac{\Delta H_{MB}}{\Delta H_{MB} + \Delta H_{FB}} = 0.5 = 50\%$$

Since, $\Delta H_{MB} = \Delta H_{FB}$ for symmetrical blades

Q143. Solution (d): Lubricants provide three major functions within your engine: cooling, cleaning and reducing friction. The goal is to protect the engine components against damage from heat, contaminants and metal-to-metal contact.

Q144. Solution (d): Given

Dia of bore = 0.20 m

length of stroke = 0.25 m

N = 600 rpm

V_{actual} = 4 m^3/min

Using relation

$$\eta_{vol} = \frac{V_{actual}}{V_{swept}}$$

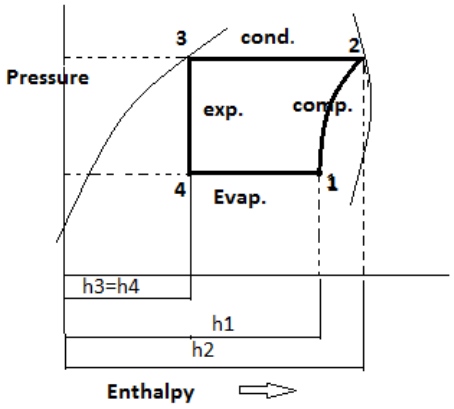
V_{swept}= $\text{Area} \times \text{length of stroke} \times \text{rpm} = \frac{\pi}{4} \times d^2 \times L \times N$ (as per question)

$$V_{swept} = \frac{\pi}{4} \times 0.20^2 \times 0.25 \times 600 = 4.712 m^3/\text{min}$$

$$\eta_{Vol} = \frac{4}{4.712} = 0.8488$$

$$\eta_{Vol} = 84.88\% \approx 85\%$$

Q145. Solution (c): The principle of vapour compression refrigeration system is based upon the fact that *evaporation causes cooling.* Whenever evaporation takes place of a liquid, it gives cooling effect.



Compression: Here, compression takes place to raise the temperature and refrigerant pressure. The refrigerant leaves the compressor and enters to the condenser.

Condensation: The condenser is essentially a heat exchanger. Heat is transferred from the refrigerant to a flow of water. This water goes to a cooling tower for cooling in the case of water-cooled condensation

Throttling and Expansion: Throttling is a highly irreversible process where a high-pressure fluid is converted into low-pressure by using a throttle valve. Evaporation: At this stage of the Vapor Compression Refrigeration Cycle, the refrigerant is at a lower temperature than its surroundings. Therefore, it evaporates and absorbs latent heat of vaporization.

Q146. Solution (b): If refrigerant or fluid inside compressor is completely gaseous during compression, then it is called dry compression. If

refrigerant or fluid is partially liquid, even minutely, during compression, then it is called wet compression.

Q147. Solution (c): Pressure in absorber is same as the pressure in evaporator and pressure in generator is same as the pressure in condenser.

Q148. Solution (b): Humidity ratio/Specific humidity (w): It is a given moist air sample is defined as the ratio of the mass of water vapour (m_w) to the mass of dry air (m_a) contained in the sample.

Enthalpy of moist air = Enthalpy of 1 kg of dry air + Enthalpy of water vapour associated with 1 kg of dry air

$h = h_a + wh_v$

Q149. Solution (b): We know that

$$Relative\ humidity, \emptyset = \frac{P_v}{P_{v_s}} = \frac{1.5}{30} = 0.5$$

Q150. Solution (d): 25 °C DBT, 60% RH

Q151. Solution (c): Given

Sensible Heat Load (S.H.F) : Latent Heat Load (L.H.L) = 3:1

Sensible Heat Factor (S.H.F) = $\frac{S.H.L}{S.H.L+L.H.L} = \frac{3}{3+1} = \frac{3}{4}$

S.H.F = 0.75

Q152. Solution (d): Centre of Pressure of a plane submerged surface

Centre of Pressure

i. For inclined surface

$$h^* = \frac{I_G \sin^2\theta}{A\bar{h}} + \bar{h}$$

ii. For vertical plate

$$h^* = \frac{I_G}{A\bar{h}} + \bar{h}$$

Here we can easily see that h^* will be greater than $\bar{h}$, hence centre of pressure will be below the centroid of surface .

Q153. Solution (d): Here it is Euler's equation

$$\frac{dP}{\rho} + gdz + vdv = 0$$

BERNOULLI'S EQUATION FROM EULER'S EQUATION

Bernoulli's Theorem:" For a steady, ideal flow of an incompressible fluid, the total energy which consists of pressure energy, kinetic energy and datum energy, at any point of the fluid is constant".

$\frac{p}{\rho g} + \frac{v^2}{2g} + z =$ constant

Here;

$\frac{p}{\rho g}$ = pressure energy per unit weight of fluid or pressure head

$\frac{v^2}{2g}$ = kinetic energy per unit weight or kinetic head

z = potential energy per unit weight or potential head

Q154. Solution (b): Darcy-Weishbach Equation

$$h_f = \frac{flv^2}{D.2g} = \frac{flQ^2}{12D^5}$$

Where;

f = frictional factor = $4f'$

f' = frictional coefficient

L = Length of pipe

D = Dia of pipe

V = Mean velocity of flow

f = friction factor (0.02 to 0.04 for metals).

h_f= head loss due to friction

Here we can easily see that if we can double the velocity then the head loss due to friction will be increase by four times.

Q155. Solution (d): Discharge through V-notch = $Q_{act} = C_d . \frac{8}{15} \tan\frac{\alpha}{2} \sqrt{2g} H^{\frac{5}{2}}$

Given in question H' = 4H

$$Q_{act}' \propto (4H)^{\frac{5}{2}}$$

$$Q_{act}' \propto 32\ H$$

Here we can clearly see that if level of water (H) of V notch is increased by 4 times, then the discharge through the notch will become 32 times.

Q156. Solution (c): The flow channel is uniform if depth slope, cross section and velocity remain constant over a given length of channel.

Q157. Solution (a): Due to its simplicity and dependability, the Venturimeter is among the most common flow meters. With no moving parts or abrupt flow restrictions, the Venturimeter can measure fluid flow rates with a minimal total pressure loss. Orifice meter is cheaper than venturimeter but high losses than venturimeter.

Q158. Solution (b): Given

Area (A) = 0.002 m^2

v = 15 m/s

u = 6 m/s

Forces exerted on the series of blades = $\rho A v(v - u)$

$$F_x = 1000 \times 0.002 \times 15(15 - 6)$$

$$F_x = 270\ N$$

Q159. Solution (c): Given

Jet ratio (m) = 8

No. of buckets = 15 + 0.5 m

= 15 +0.5×8

= 19

Q160. Solution (c): Speed $(N_s) = \frac{120f}{p}$

$N_s = \frac{120 \times 50}{12}$ = 500 rpm

Q161. Solution (b): The Francis turbine is a type of water turbine that was developed by James B. Francis. It is an inward flow reaction turbine that combines radial and axial flow concepts. In such turbines, the water enters the wheel at the outer periphery and then flows inwards (i.e. towards the centre of the wheel).Here the runner is surrounded by a guide mechanism. In this turbine, the outer diameter of the runner is the inlet and the inner diameter is the outlet.

Q162. Solution (b): Kaplan turbine is a complete reaction turbine that works based on the lift force generated on the impeller blades due to its aerofoil shape [29]. The working process of the Kaplan turbine is similar to the propeller-type turbine along with adjustable runner blades so that it can work smoothly at vortices and shocks during partial load conditions

Q163. Solution (d): Net Positive Suction Head

Q164. Solution (d): Wet bulb depression is a difference between dry bulb temperature and wet bulb temperature at any point

Wet Bulb Depression = DBT-WBT

*For a saturated air wet bulb depression is zero.

Q165. Solution (c): An air washer is a device for conditioning air. In an air washer air comes in direct contact with a spray of water and there will be an exchange of heat and mass (water vapour) between air and water.

Q166. Solution (a): Austenite is a solid solution of carbon in gamma iron.

Q167. Solution (c): A heading tool or ram is positioned perpendicular to the cross sectioned end face of a rod or bar gripped in a die. On application of pressure, the length of the rod is reduced and the diameter is increased (upset).

Q168. Solution (d): Submerged ARC welding method is widely used in thick plate welding. It is more efficient than conventional welding process like MIG/SMAW welding.

Q169. Solution (b): Most common natural defects are: knots, shakes, cross grain, crookedness, rind galls, burr, and curl.

Q170. Solution (c): Pincer is used for extracting deep embedded nails from timber. Suitable for extracting nails from concrete.

Q171. Solution (c): Oxidizing Flame: Oxygen to Acetylene ratio is greater than one. Application-Copper, Brass, Zinc, Bronze etc.

Q172. Solution (d): Thermit mixture can be heated in a crucible upto 1200℃ using Mg rod and crackers. At this temperature due to thermit reaction heat will be produced & iron is separated. Al_2O_3 will be acting as a slag.

Thermit reaction

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe + \Delta h$$

Application: Repair works of railway rails, Joining of high thickness plates and broken castings.

Q173. Solution (d): In Powder metallurgy process the production rate is very high. So option d is the correct answer.

Q174. Solution (d): The permeability decreases, if sand mixture containing grains of all sizes.

Q175. Solution (c): Grinding: Grinding is an abrasive machining process that uses a grinding wheel or grinder as the cutting tool. Grinding is a subset of cutting, as grinding is a true metal-cutting process. Grinding is very common in mineral processing plants and the cement industry. Grinding is used to finish workpieces that must show high surface quality and high accuracy of shape and dimension.

Q176. Solution (b): Continuous Chip with built up edge is obtained by machining on ductile material, in this condition of high local temperature and extreme pressure in the cutting and high friction in the tool chip interference, may cause the work material to adhere or weld to the cutting edge of the tool.

Q177. Solution (a): Value of n = 0.1 to 0.2; for H.S.S. tools

0.2 to 0.4; for Carbide tools

0.4 to 0.6; for Ceramic tools

Q178. Solution (c): The cutting tool used in a shaper is a single point cutting tool having rake, clearance and other tool angles similar to a lathe tool.

Q179. Solution (d): Helix angle is the angle between the leading edge of the land and the axis of the drill. It is also known as the spiral angle. The usual range of helix angle used in the drill is 24° to 30°.

Q180. Solution (d): Cutting fluids performs several functions and some of them are cool the tool and workpiece.

i. Reduce the friction

ii. Protect work against rusting

iii. Improve the surface finish

iv. Prevent the formation of Built-up edges (BUEs)

v. Wash away the chips from the cutting zone