General Aptitude

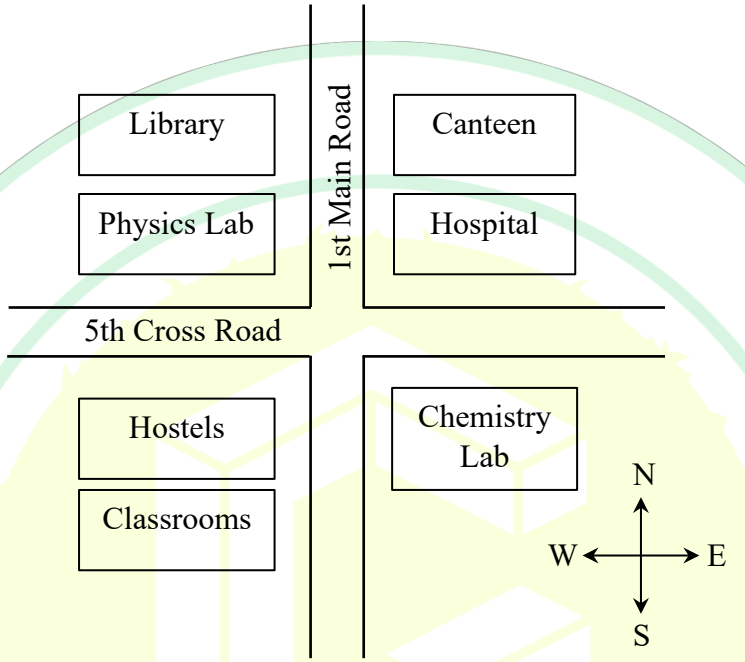
Q.1 – Q.5 Carry ONE mark Each

Q.1	Ravi had _____ younger brother who taught at _____ university. He was widely regarded as _____ honorable man. Select the option with the correct sequence of articles to fill in the blanks.
(A)	a; a; an
(B)	the; an; a
(C)	a; an; a
(D)	an; an; a

Q.2	The CEO's decision to downsize the workforce was considered myopic because it sacrificed long-term stability to accommodate short-term gains. Select the most appropriate option that can replace the word "myopic" without changing the meaning of the sentence.
(A)	visionary
(B)	shortsighted
(C)	progressive
(D)	innovative

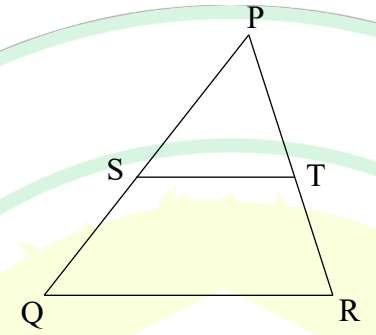
Q.3	The average marks obtained by a class in an examination were calculated as 30.8. However, while checking the marks entered, the teacher found that the marks of one student were entered incorrectly as 24 instead of 42. After correcting the marks, the average becomes 31.4. How many students does the class have?
(A)	25
(B)	28
(C)	30
(D)	32

Q.4	Consider the relationships among P, Q, R, S, and T: • P is the brother of Q. • S is the daughter of Q. • T is the sister of S. • R is the mother of Q. The following statements are made based on the relationships given above. (1) R is the grandmother of S. (2) P is the uncle of S and T. (3) R has only one son. (4) Q has only one daughter. Which one of the following options is correct?
(A)	Both (1) and (2) are true.
(B)	Both (1) and (3) are true.
(C)	Only (3) is true.
(D)	Only (4) is true.

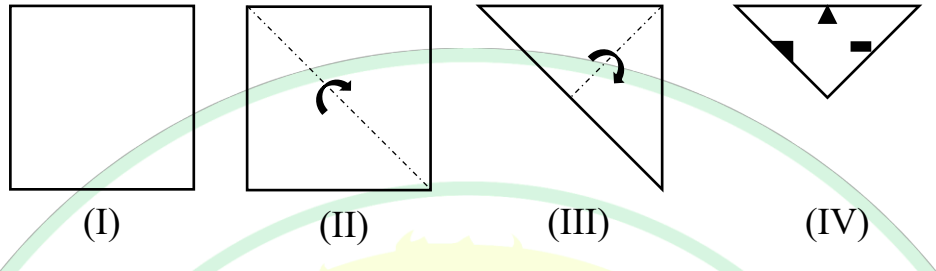
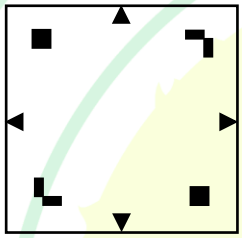
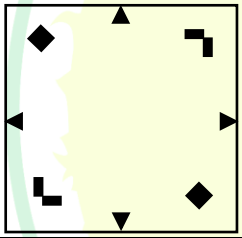
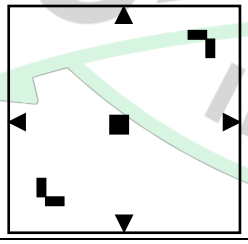
Q.5	According to the map shown in the figure, which one of the following statements is correct? Note: The figure shown is representative.
	
(A)	The library is located to the northwest of the canteen.
(B)	The hospital is located to the east of the chemistry lab.
(C)	The chemistry lab is to the southeast of physics lab.
(D)	The classrooms and canteen are next to each other.

Q.6 – Q.10 Carry TWO marks Each

Q.6	"I put the brown paper in my pocket along with the chalks, and possibly other things. I suppose every one must have reflected how primeval and how poetical are the things that one carries in one's pocket: the pocket-knife, for instance the type of all human tools, the infant of the sword. Once I planned to write a book of poems entirely about the things in my pocket. But I found it would be too long: and the age of the great epics is past." (From G.K. Chesterton's "A Piece of Chalk") Based only on the information provided in the above passage, which one of the following statements is true?
(A)	The author of the passage carries a mirror in his pocket to reflect upon things.
(B)	The author of the passage had decided to write a poem on epics.
(C)	The pocket-knife is described as the infant of the sword.
(D)	Epics are described as too inconvenient to write.

Q.7	In the diagram, the lines QR and ST are parallel to each other. The shortest distance between these two lines is half the shortest distance between the point P and line QR. What is the ratio of the area of the triangle PST to the area of the trapezium SQRT? Note: The figure shown is representative.
	
(A)	$\frac{1}{3}$
(B)	$\frac{1}{4}$
(C)	$\frac{2}{5}$
(D)	$\frac{1}{2}$

Q.8	A fair six-faced dice, with the faces labelled ‘1’, ‘2’, ‘3’, ‘4’, ‘5’, and ‘6’, is rolled thrice. What is the probability of rolling ‘6’ exactly once?
(A)	$\frac{75}{216}$
(B)	$\frac{1}{6}$
(C)	$\frac{1}{18}$
(D)	$\frac{25}{216}$

Q.9	A square paper, shown in figure (I), is folded along the dotted lines as shown in the figures (II) and (III). Then a few cuts are made as shown in figure (IV). Which one of the following patterns will be obtained when the paper is unfolded? Note: The figures shown are representative.
	 (I) (II) (III) (IV)
(A)	
(B)	
(C)	
(D)	

Q.10	A shop has 4 distinct flavors of ice-cream. One can purchase any number of scoops of any flavor. **The order in which the scoops are purchased is inconsequential.** If one wants to purchase 3 scoops of ice-cream, in how many ways can one make that purchase?
(A)	4
(B)	20
(C)	24
(D)	48

Q.11 – Q.35 Carry ONE mark Each

Q.11	If a, b, and c are the roots of $2x^3 - 3x^2 + px - 1 = 0$ and sum of the two roots is 1, the value of p is:
(A)	2
(B)	1
(C)	3
(D)	$\frac{1}{3}$
Q.12	If the matrix $\begin{bmatrix} x & -3 \\ 2 & x-5 \end{bmatrix}$ is singular, sum of the values of x is:
(A)	5
(B)	6
(C)	0
(D)	-1

Q.13	$\frac{s}{s^2+a^2}$ is the Laplace transform of :
(A)	$\cos at$
(B)	$\sin at$
(C)	$\sinh at$
(D)	$\cosh at$
Q.14	$y'' + p(x)y' + q(x)y = r(x)$ is a _____ ordinary differential equation.
(A)	second order, nonhomogeneous, and linear
(B)	second order, homogeneous, and linear
(C)	second order, homogeneous, and nonlinear
(D)	first order, nonhomogeneous, and linear

Q. 15	The median of the following set of numbers: 154, 130, 144, 137, 156, 146, 138, 149, 160, 138 is:
(A)	145.0
(B)	145.2
(C)	151.0
(D)	146.0
Q.16	Which of the following method is used for the geophysical exploration of groundwater:
(A)	Electric Resistivity method
(B)	Test Boring method
(C)	Tracer method
(D)	Remediation method

Q.17	Identify the correct statement related to tape correction in chain surveying:
(A)	Wrong alignment correction is always positive.
(B)	Sag correction is always negative.
(C)	Slope of tape correction is always positive.
(D)	Temperature correction is always negative.
Q.18	The sphericity of a cylindrical potato sample having diameter of 1.0 cm and length of 5.0 cm is closest to:
(A)	0.98
(B)	0.70
(C)	0.31
(D)	0.17

Q.19	The condition of refrigerant at the exit of the compressor in a vapor compression refrigeration system is:
(A)	Saturated liquid
(B)	Wet vapor
(C)	Dry saturated vapor
(D)	Superheated vapor
Q.20	While sowing mustard seeds (bulk density = 800 $kg.m^{-3}$), a four-row fluted roller type seed drill with 25 cm row spacing operates at a speed of 2.5 $km.h^{-1}$. For a desired seed rate of 5.0 $kg.ha^{-1}$, the flowrate of seeds from the machine in $m^3.h^{-1}$ is:
(A)	0.391×10^{-3}
(B)	1.172×10^{-3}
(C)	1.563×10^{-3}
(D)	1.953×10^{-3}

Q.21	By tripling the RMS sound pressure, the resulting increase in the sound pressure level in dB is closest to:
(A)	9.54
(B)	6.02
(C)	4.77
(D)	3.01
Q.22	While studying vertical motion imparted to the base of tractor seat, θ (radian) is considered as rotation about tractor's CG and R is considered as longitudinal distance from operator's seat to the tractor's CG. For a small value of θ, the term '$R\theta$' represents the vertical motion resulting from tractor's _____.
(A)	pitch motion
(B)	roll motion
(C)	yaw motion
(D)	lateral motion

Q. 23	In rice milling, the rubber roll sheller is used for:
(A)	Separating paddy from brown rice
(B)	Removal of bran adhering to rice kernels
(C)	Separating husk layer from paddy grains
(D)	Removal of husk layer from white rice
Q. 24	In general, result(s) of blanching fresh fruits and vegetables is/are:
(A)	Complete elimination of microorganisms
(B)	Removal of entrapped air pockets between plant tissues
(C)	Leaching of nutrients
(D)	Inactivation of enzymes

Q.25	Identify the adverse effect(s) due to soil salinity or alkalinity or both:
(A)	Low yields of crops
(B)	Increased infiltration leading to waterlogging
(C)	Poor quality of fodder
(D)	Limited type of crops can be grown

Q.26 Match the terms in Column I with the suitable hydrometeorological variables in Column II.

Column I		Column II	
P	Isopleth	1	Rainfall
Q	Isobath	2	Pressure
R	Isohyet	3	Evapotranspiration
S	Isochrone	4	Groundwater
T	Isobar	5	Surface runoff

(A) P-4, Q-3, R-1, S-5, T-2

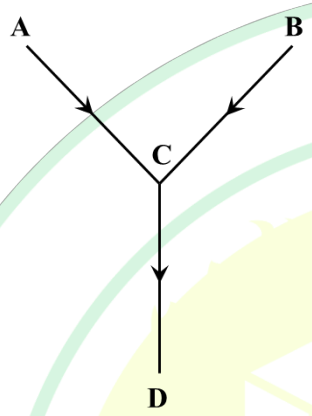
(B) P-5, Q-4, R-1, S-3, T-2

(C) P-3, Q-4, R-1, S-5, T-2

(D) P-3, Q-4, R-2, S-5, T-1

Q.27	Identify correct statement(s) for sprinkler irrigation:
(A)	Excessive topsoil erosion is involved.
(B)	Fertilizer can be applied with water.
(C)	No excess cost of land preparation is involved.
(D)	Evapotranspiration loss is minimum.
Q.28	Which of the following method(s) is/are generally used in spark ignition engines for evaluating volatility?
(A)	Distillation test
(B)	Motor method
(C)	Pensky Martens closed tester
(D)	Reid vapor pressure test
Q.29	The nominal radius of the rear wheels of a 2WD tractor is 0.5 m. The rolling radius of the tire is 6% less than the nominal radius. While conducting a field test, if the actual distance covered for 20 revolutions of the rear wheel is found to be 56 m, the rear wheel slip is _____%. (*Rounded off to 2 decimal places*)

Q.30	Front wheel pivot points of a 2WD tractor are 1.2 m apart. When making turn on a flat concrete surface, the inner front wheel makes 50^{o} and the outer front wheel makes 35^{o} steering angles. To ensure turning without front wheel skid, the wheel base of the tractor should be _____ m. (*Rounded off to 2 decimal places*)
Q.31	An unconfined aquifer having a hydraulic conductivity of 12 $m.day^{-1}$ covers an area of 1.0 ha. When this aquifer is pumped, it releases 6000 m^3 of water and the water table drops from 3 m to 7 m below the ground level. The specific yield of the aquifer is _____ %. (*Answer in integer*)
Q.32	Apple slices are dried from a moisture content of 65% (dry basis) to 10% (dry basis) in a hybrid solar dryer under falling rate period. The apple slices have a drying rate constant of $\frac{1}{104}$ $minute^{-1}$. Considering an equilibrium moisture content of 2% (dry basis), the time required for drying is _____ minutes. (*Rounded off to 2 decimal places*)
Q.33	The quantity of water needed to increase the moisture content of 50 kg paddy grains from 13% (dry basis) to 35% (dry basis) in the hydrothermal treatment process is _____ kg. (*Rounded off to 2 decimal places*)
Q.34	Considering acceleration due to gravity as 9.81 $m.s^{-2}$ and π as 3.14, the critical speed of a ball mill having 3600 mm mill diameter and 160 mm ball diameter is _____ rpm. (*Answer in integer*)

Q.35	Three straight metal wires, AC, BC and CD, having same length, diameter and thermal conductivity are connected as shown in the figure. Heat flows from points 'A' and 'B' to point 'C' and from point 'C' to 'D'. Temperatures at points A, B and D are 100 °C, 100 °C and 40 °C, respectively. Assuming steady-state condition and no heat loss from the wires, the temperature at point 'C' is _____ °C. (*Answer in integer*)
	

Q.36 – Q.65 Carry TWO marks each

Q.36	The series $\sum_{n=0}^{r} q^n = 1 + q + q^2 + \cdots\cdots\cdots$ has the sum:
(A)	$\frac{1}{1-q} - \frac{q^{r+1}}{1-q}$
(B)	$\frac{1}{q-1} + \frac{q^{r+1}}{q-1}$
(C)	$\frac{1}{1-q} + \frac{q^{r+1}}{1-q}$
(D)	$\frac{1}{q-1}$

Q.37	The value of $\lim_{x\to 0} \frac{x\cos x - \sin x}{x^2 \sin x}$ is:
(A)	$-\frac{1}{3}$
(B)	$\frac{1}{3}$
(C)	3
(D)	-3
Q.38	If $u = x^4 + y^4 + 3x^2y^2$, the value of $\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right)^{-1}$ is:
(A)	$4u$
(B)	0
(C)	$\frac{1}{4u}$
(D)	$2u$

Q.39	Steady flow condition in a confined aquifer occurs when:
(A)	the rate of recharge is more than the rate of groundwater discharge.
(B)	the rate of recharge is equal to the rate of groundwater discharge.
(C)	the rate of recharge is less than the rate of groundwater discharge.
(D)	the pumping rate is more than the safe yield of the aquifer.
Q.40	Lysimeter is an instrument used to measure the following process(es):
(A)	Evaporation
(B)	Infiltration
(C)	Evapotranspiration
(D)	Deep percolation

Q.41	The assumption(s) which is/are **not correct** for deriving the Plank's equation for estimation of food freezing time:
(A)	Ice front moves from the freezing medium into the food block at a uniform rate.
(B)	Physical property data of food material are accurate.
(C)	Initially the whole food material is at a distinct freezing point.
(D)	Sensible heat changes during the freezing process are sufficiently high.

Q.42 Match the following psychrometric processes (Column I) with the respective changes in thermodynamic properties (Column II) of air-water vapor mixture:

Column I		Column II	
1	Sensible cooling	P	Dry bulb temperature increases and dew point temperature decreases
2	Cooling and dehumidification	Q	Dry bulb temperature increases and dew point temperature increases
3	Chemical dehumidification	R	Dry bulb temperature decreases and dew point temperature remains constant
4	Heating and humidification	S	Dry bulb temperature decreases and dew point temperature decreases

(A) 1-R, 2-S, 3-Q, 4-P

(B) 1-P, 2-R, 3-S, 4-Q

(C) 1-R, 2-S, 3-P, 4-Q

(D) 1-P, 2-Q, 3-S, 4-R

Q.43	The value of y at $x = 0.3$ and $y(x = 0) = 0$ for the differential equation $\frac{dy}{dx} = 3y + 2e^x$ is _____. (*Rounded off to 3 decimal places*)
Q.44	A flat plate solar collector located at Bhopal (23°15′N, 77°42′E) is tilted at an angle of 30° with the horizontal and facing due South. Considering hour angle as 45°, the angle made by the beam radiation with normal to the collector plate on June 30, 2023 at 3:00 PM (Local Apparent Time) is _____ degree. (*Rounded off to 2 decimal places*)
Q.45	A six-stage centrifugal pump delivers water at the rate of 150 $L.s^{-1}$ against a net pressure rise of 5003 $kN.m^{-2}$. The pump impeller rotates at 1450 rpm. If the acceleration due to gravity is 9.81 $m.s^{-2}$, the specific speed of the pump is _____. (*Answer in integer*)
Q.46	Water flows through a 90° V-notch weir having a discharge coefficient of 0.6. If the depth of water above the notch is 49 cm and the acceleration due to gravity is 9.81 $m.s^{-2}$, the discharge over the notch is _____ $m^3.s^{-1}$. (*Rounded off to 2 decimal places*)
Q.47	The volume and voids ratio of an undisturbed soil sample are 100 cm^3 and 0.60, respectively. After oven drying, the mass of this sample is reduced from 185 g to 165 g without any shrinkage in the volume. If the specific gravity of this sample is 2.64, the degree of saturation of this soil is _____ %. (*Rounded off to 2 decimal places*)

Q.48	A 10 ha watershed experiences a rainfall of 15 mm, evapotranspiration of 5 mm, infiltration of 4.5 mm, deep percolation of 2.2 mm, detention storage of 0.5 mm, and other abstraction losses of 0.3 mm during the storm event. Neglecting other surface storages, the total overland flow generated from the watershed due to this storm event is _____ m^3. (*Answer in integer*)
Q.49	To protect a wheat field from wind erosion, windbreaks of 2.7 m height are provided. The actual wind velocity at 15 m height perpendicular to the wind barrier is 9 $m.s^{-1}$ and the minimum wind velocity at 15 m height required to move the most erodible soil fraction is 9.6 $m.s^{-1}$. The distance of full protection from this windbreak is _____m. (*Rounded off to 2 decimal places*)
Q.50	A stable drop structure is designed with a base length of 5.7 m. The sum of vertical forces excluding uplift is 92.5 kN, sum of uplift forces is 72.5 kN, and sum of moments of all the horizontal and vertical forces about an axis passing through mid-section of base length is 60 kN.m. The eccentricity denoting the longitudinal distance between the centroid of base area and the point of application of resultant vertical load is _____ m. (*Rounded off to 2 decimal places*)
Q.51	An 8 ha watershed receives rainfall intensities of 2.5, 3.6, 5.4, 3.3, 2.6 and 1.2 $cm.h^{-1}$ at the successive interval of 30 minutes. The corresponding surface runoff volume is estimated to be 4800 m^3. Neglecting initial abstraction losses, the W-index for this watershed is _____ $cm.h^{-1}$. (*Rounded off to 2 decimal places*)
Q.52	A four-stroke diesel engine has a displacement volume of 6.0 L and it operates at 2300 rpm with 75% mechanical efficiency. The indicated mean effective pressure is 800 kPa. If the engine has brake-specific fuel consumption of 320 $g.h^{-1}.kW^{-1}$, considering calorific value of the fuel as 44.6 $MJ.kg^{-1}$, the fuel equivalent power is _____ kW. (*Rounded off to 2 decimal places*)

Q.53	An engine's torque-speed characteristics is given below: T_{maxP} = 125 N.m N_{maxP} = 2400 rpm N_{HI} = 2600 rpm T_{max} = 160 N.m N_{maxT} = 1450 rpm where, T_{maxP} = torque at maximum power T_{max} = maximum torque N_{maxP} = speed at maximum power N_{maxT} = speed at maximum torque N_{HI} = speed at high idle The Governor's regulation is _____ %. (*Rounded off to 2 decimal places*)
Q.54	An engine, running at 1200 rpm, drives a 1.2 m diameter rigid wheel on a non-deformable surface at 5 $km.h^{-1}$ forward speed. The power is transmitted from engine to the wheel through a transmission gear box (gear ratio = 3:1), a differential (gear ratio = 4:1), and a final drive (gear ratio = n:1). Neglecting the deformation of the wheel and wheel slip, the value of n is _____. (*Rounded off to 2 decimal places*)
Q.55	A solid round uniform diameter shaft is transmitting 25 kW power at 540 rpm. The maximum allowable shear stress of the shaft material is 35 MPa. If the maximum torque exceeds the mean torque by 20%, neglecting the bending effect, the minimum shaft diameter is _____ mm. (*Rounded off to 2 decimal places*)
Q.56	The height of CG of a 4WD tractor with equal tread (1.25 m) in front and rear is 0.85 m. The tractor overturns during turning at a speed of 18 $km.h^{-1}$. Neglecting the frictional forces on the tractor wheels, the turning radius is _____m. (*Rounded off to 2 decimal places*)

Q.57	A horizontal axis wind turbine with 24 m diameter blades, running with an average wind velocity of 6.0 $m.s^{-1}$, is used for pumping irrigation water. The average air density is 1.23 $kg.m^{-3}$. Considering coefficient of power as 0.3, transmission efficiency as 90%, pump efficiency as 60%, acceleration due to gravity as 9.81 $m.s^{-2}$ and density of water as 1000 $kg.m^{-3}$, the discharge of the pump for a total head of 20 m is_____ $L.s^{-1}$. (*Rounded off to 2 decimal places*)
Q.58	A mouldboard plough is operated by a 2WD tractor with 6.0 kN pull. The ratio of lateral component to the longitudinal component of soil forces is 0.30, and the ratio of the vertical component to the longitudinal component of soil forces is 0.50. If diameter of the driving wheels is 1.2 m and the rear axle rotates at 10 rpm, the drawbar power produced at 20% wheel slip is_____ kW. (*Rounded off to 2 decimal places*)
Q.59	For a right-hand offset disc harrow, the longitudinal distance from the hitch point to the centers of the front and rear gangs are 2.5 m and 4.5 m, respectively. The resultant horizontal soil forces in longitudinal direction on the front and rear gangs are 3.0 kN and 3.5 kN, respectively; while the resultant horizontal soil forces in lateral directions are 2.5 kN and 4.0 kN, respectively. Considering the resultant soil forces acting at the centers of front and rear gangs, the amount of offset of the center of cut with respect to the hitch point is _____ m. (*Rounded off to 2 decimal places*)
Q.60	Locust beans having average particle diameter of 7 mm are ground at a rate of 10 $ton.h^{-1}$ to produce average particle diameter of 0.62 mm. The mill consumes 6.7 kW power at the given rate. For the same rate of grinding, using Rittinger's law, the power required to grind the beans to an average particle diameter of 0.25 mm is _____ kW. (*Rounded off to 2 decimal places*)

Q.61	A mixture of Nitrogen (N_2) and Helium (He) gases is contained in a pipe at 1.0 atm pressure and at 298 K. At one point in the pipe, the partial pressure of N_2 is 60.80 kPa and at a point 0.22 m apart, the partial pressure of N_2 is 20.31 kPa. The diffusion coefficient of the mixture is 0.612×10^{-4} $m^2.s^{-1}$. Considering Universal gas constant as 8314 $m^3.Pa.kg\ mol^{-1}.K^{-1}$, the steady-state flux of N_2 is $n\times10^{-6}$ kg $mol.s^{-1}.m^{-2}$. The value of n is _____. (*Rounded off to 2 decimal places*)
Q.62	Milk enters at 25 °C through inner pipe of a concentric double pipe heat exchanger. Hot water enters at 82.5 °C and flows countercurrently (flow rate = 1.2 $kg.s^{-1}$) through the annular region. The diameter of inner pipe, length of the pipe and average overall heat transfer coefficient are 60 mm, 6 m, and 2100 $W.m^{-2}.K^{-1}$, respectively. The average values of specific heat capacity of water and milk are 4.18 $kJ.kg^{-1}.K^{-1}$ and 3.95 $kJ.kg^{-1}.K^{-1}$, respectively. The effectiveness of the heat exchanger is 0.572 and the NTU is 1.01. Assuming the steady-state condition and considering π as 3.14, the temperature of hot water at exit of the pipe is _____ °C. (*Rounded off to 1 decimal place*)
Q.63	In an inoculated pack study, 0.5 kg peas per can are thermally processed at 121 °C. One group of cans contain *Clostridium spp.* spores with initial spore level of 5×10^{10} per can. Another group of cans contain *Bacillus spp*. spores. It is desired to have spoilage probability of 5 in 100 cans after thermal processing. The decimal reduction time of *Clostridium spp.* and *Bacillus spp*. at 121 °C are 2.5 minutes and 6.0 minutes, respectively. If all the cans receive same lethality, the initial number of spores of *Bacillus spp*. per g of peas is _____. (*Answer in integer*)
Q.64	Apple juice (viscosity = 1.6 cP) is being filtered through a 2 m^2 filter under a constant pressure. The juice has solid concentration of 0.04 $g.mL^{-1}$ in filtrate. The total pressure drop is 325.33 kPa. The values of cake and filter medium resistance are 1.85×10^{11} $m.kg^{-1}$ and 3.50×10^{11} m^{-1}, respectively. The time required to filter 800 litres of juice is _____ hour. (*Answer in integer*)

Q.65	A cylindrical concrete silo of 6 m internal diameter and 24 m height is filled with rough rice having bulk density of 635 kg.m^{-3}. The angle of friction between concrete wall and rough rice is 30°. The ratio between lateral and vertical pressure is 0.4. The ratio of lateral pressure at 10 m depth to the 5 m depth is _____. (*Rounded off to 2 decimal places*)