

Q1) Complement of the Solar Altitude angle is _____.

- (A) Zenith angle
- (B) Azimuth angle
- (C) Hour angle
- (D) Profile angle

Q2) The shape of falling limb of a hydrograph is dependent on _____

- (A) basin and storm characteristics
- (B) storm characteristics only
- (C) basin characteristics only
- (D) direction of the rainfall only

Q3) The ratio of inertial forces to viscous forces is known as _____

- (A) Froude number
- (B) Reynolds number
- (C) Power number
- (D) Biot number

Q4) The ratio of soil loss from the field plot length to that from the unit plot with a slope length of 22.13 m is 0.5. If the slope length from the watershed divide is 600 m and the slope gradient is 8%, the topographic factor in the Universal Soil Loss Equation is _____. [round off to two decimal places]

Q5) The area of a rectangular field was measured using a 30 m survey chain, which was later found to be 5 cm short. If the length and width of the field measured using this chain were 542 m and 554 m, respectively, the true area of the field in ha is _____. [round off to two decimal places]

Q6) If an osmo-dehydrated fruit slice has 72% moisture content on wet basis, the moisture content of the same fruit slice on dry basis in percent is _____. [round off to one decimal place]

Q7) A 5×20 cm seed drill has a ground drive wheel of rolling diameter 0.5 m. While testing under laboratory condition, 320 g of seeds were collected in 20 revolutions of the ground drive wheel. The same seed drill when operated in a 2 ha field, the amount of seeds dropped was found to be 185 kg. The variation in the seed dropped between laboratory and field conditions due to skid of ground drive wheel is _____

(Take $\pi = 3.14$)

- (A) 6.38%
- (B) 9.23%

- (C) 10.17%
- (D) 12.26%

Q8) A 3.6 m combine harvester was tested over a crop strip of 20 m length and the following data were obtained while testing:

Total material left over walker = 8.5 kg

Free seed over walker = 100 g

Unthreshed seed over walker = 50 g

Total material left over shoe = 5.5 kg

Free seed over shoe = 250 g

Unthreshed seed over shoe = 80 g

Total seed collected in the grain tank = 16.5 kg

The grain yield (tonne ha^{-1}) and cylinder loss (%), respectively, are

- (A) 2.36 and 0.77
- (B) 4.24 and 0.29
- (C) 6.28 and 0.47
- (D) 8.05 and 2.82

Q9) The pressure drop through a well-designed constriction is to be used for measuring the velocity of flow through a circular pipe. If the pressure drop from a 0.1 m diameter section to a 0.05 m diameter section of the pipe is 7.5 kPa, the velocity in m s^{-1} in the 0.1 m diameter section of the pipe is _____.

(Take density of liquid = 1000 kg m^{-3})

- (A) 0.5
- (B) 1.0
- (C) 1.5
- (D) 2.0

Q10) The water activity of potato is 0.942. As per Raoult's law, the most efficient solution for osmotic dehydration of potato is _____.

(Molar mass of sucrose = 342 g mole^{-1} , and NaCl = 58.5 g mole^{-1})

- (A) 20% sucrose solution
- (B) 20% NaCl solution
- (C) 10% sucrose solution + 10% NaCl solution
- (D) 15% sucrose solution + 5% NaCl solution

Q11) Match the following reactants in Column I with the most appropriate purpose used in processing as mentioned in Column II

Column I		Column II	
I	Vitamin E	P	fumigant for insect killing
II	Calcium salts	Q	reduces shrinkage losses
III	Edible waxes	R	antioxidant with vitamin A in oils
IV	Methyl Bromide	S	firming agent in fruits

- (A) I-P, II-S, III-Q, IV-R
 (B) I-R, II-Q, III-S, IV-P
 (C) I-P, II-Q, III-S, IV-R
 (D) I-R, II-S, III-Q, IV-P

Q12) The root mean square acceleration for mechanical vibration of a tractor is 3.15 m s^{-2} and its frequency is 80 Hz. The root mean square amplitude of the vibration in μm is _____.
 [round off to two decimal places]

(Take $\pi = 3.14$)

Q13) The crank radius and connecting rod length of an IC engine are 250 mm and 1000 mm, respectively. If the crank turns 100° from the head dead centre and the net force acting on the piston along its direction of motion is 35 kN, the turning moment of the crank shaft at that instant in kN m is _____. [round off to two decimal places]

Q14) A tractor operated 12×60 cm boom sprayer had an overlap of 30 cm between the successive passes during field operation at an average speed of 4.2 km h^{-1} . A total time loss of 7.5 min ha^{-1} was observed during turnings. Assuming no overlap of spray material between adjacent nozzles, the field efficiency of the sprayer in percent is _____. [round off to two decimal places]

Q15) In a subsurface drainage network, 12 lateral drains each of 100 m long are laid at a spacing of 50 m. These lateral drains are connected to a collector drain. When the water table dropped 50 cm below the soil surface in 4 days, the average discharge at the outlet of the collector drain was found to be 12 L s^{-1} . The average drainable porosity of soil in percent is _____. [round off to two decimal places]

Q16) A watershed with various land uses (as specified in the table below) receives a rainfall of 152.4 mm. If an initial abstraction (I_a) is 0.2 times the potential maximum retention (S), and the antecedent moisture content (AMC) of averaged condition is assumed, the depth of runoff volume in mm is _____. [round off to two decimal places]

Land Use (%)	Soil Group	Curve Number
Residential, 40%	C	83
Open space- good condition, 25%	D	80
Commercial and business, 20%	C	94
Industrial, 15%	D	93

Q17) A trapezoidal weir has a side slope of 1 horizontal unit to 4 vertical units. The length of the weir is less than the width of the channel. If the head over the weir is 70 cm and the discharge is $0.85 \text{ m}^3 \text{ s}^{-1}$, the length of the weir in m is _____. [round off to two decimal places] (Take coefficient of discharge = 0.62 and $g = 9.81 \text{ m s}^{-2}$)

Q18) A sprinkler irrigation system with an irrigation efficiency of 70% is used to irrigate 16 ha of maize crop. The crop evapotranspiration of 6 mm day^{-1} is used for estimating the irrigation depth. If the irrigation system is operated 20 hours per day for 10 days, the system capacity in L s^{-1} is _____. [round off to two decimal places]

Q19) A cylindrical metallic silo of 3 m internal diameter and 10 m depth is loaded with maize grain having bulk density of 720 kg m^{-3} . The angle of internal friction between the maize grains is 24° , and that between the grain and wall is 22° . Using Airy's theory, the calculated lateral pressure in kPa at the bottom of the silo is _____. [round off to two decimal place] (Take $g = 9.81 \text{ m s}^{-2}$)

Q20) Sweet sorghum with an initial average particle size of 4.0 mm was pulverised using a burr mill at two different gap settings between stones. The average feed rate of the material is 200 kg h^{-1} . The resultant flour was analysed by IS sieves for particle size determination and was found to be 0.336 mm and 0.306 mm for the first and second gap settings, respectively. Using Kick's law, if the power required to grind the sorghum at first setting is 7.2 kW, the power requirement in kW with the second setting is _____. [round off to two decimal places]

Q21) The constituent of producer gas which occupies the highest percentage by volume and helps in increasing its overall calorific value is

- (A) CO
- (B) CO₂
- (C) H₂
- (D) CH₄

Q22) During field operation, the shank of a tractor drawn rigid tyne sweep type cultivator is mainly subjected to

- (A) bending
- (B) shear
- (C) torsion
- (D) bending and torsion

Q23) The power developed and the exhaust gas temperature of a diesel engine compared to a spark ignition engine of the same size and running at the same speed respectively, are

- (A) higher and lower
- (B) higher and higher
- (C) lower and higher
- (D) lower and lower

Q24) In a semi-modular outlet, the discharge

- (A) is independent of water levels in the distributary and the water course
- (B) depends upon the water levels of both distributary and water course
- (C) depends upon the water level in the distributary
- (D) depends upon the water level in the water course

Q25) A trapezoidal grassed waterway is constructed along a longitudinal gradient of 4%. If the cross-sectional area of flow is 1.52m², wetted perimeter is 12.5 m and Manning's n for the waterway is 0.04 m^{-1/3} s, the flow through the waterway in m³ s⁻¹ is

- (A) 1.9
- (B) 2.1
- (C) 2.3
- (D) 2.5

Q26) A single acting reciprocating pump discharges 3.5 litres of water per second at 40 rpm. The pump has a piston diameter of 150 mm and a stroke of 300 mm. The percentage slip is

- (A) 0.85
- (B) 1.97
- (C) 3.53

(D) 6.05

Q27) A packed bed of 480 kg solid particles having particle size of 0.15 mm and density of 800 kg m^{-3} is fluidized using air at 25°C and 1 atmospheric pressure. If the cross section of the empty bed is 0.45 m^2 and voidage at minimum fluidizing condition is 0.5, then the minimum height of the fluidized bed, in m is

- (A) 7.4
- (B) 5.4
- (C) 2.7
- (D) 1.0

Q28) A tractor power take-off (PTO) driven stationary peg tooth type wheat thresher operating at a cylinder speed of 540 rpm requires a torque of 250 Nm at PTO. The minimum net engine power required, in kW is

- (A) 13
- (B) 16
- (C) 18
- (D) 21

Q29) A two wheel drive tractor, weighing 15.84 kN with a wheel base of 2160 mm, has the static weight divided between the front and rear axles in the ratio of 30 : 70 on a horizontal level surface. The hitch point is at a height of 700 mm from the ground and at a horizontal distance of 120 mm to the rear side from the centre of the rear axle. Pull acts at an angle of 12° downwards from the horizontal. The maximum pull in kN, when the front wheels would just start rising from the ground is

- (A) 1.48
- (B) 14.46
- (C) 39.04
- (D) 85.54

Q30) A horizontal axis drag type wind mill with square blades and a horizontal axis lift type wind mill with airfoil section blades having same rotor size are installed at a height of 10 m above the ground. The average wind speed is 25 km h^{-1} . The maximum power coefficient for drag type and lift type wind mills is 0.148 and 0.593, respectively. If the maximum power extracted by drag type wind mill is 5 kW, the corresponding power extracted by lift type wind mill, in kW is

- (A) 8.43
- (B) 12.63
- (C) 18.03
- (D) 20.03

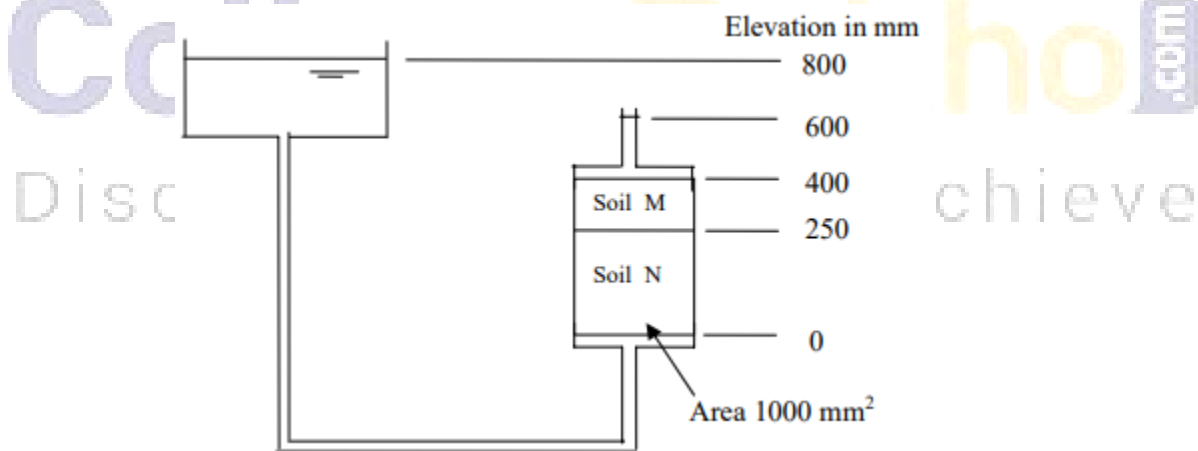
Q31) The thresher of a wheat combine harvester has an optimal throughput capacity of 2400 kg (crop) per hour. The harvester has a forward velocity of 4.5 km h^{-1} . Sample tests have revealed that the yield of crop in the field is 3000 kg (grain) per ha. Grain to straw ratio is 60 : 40. If the above throughput is to be maintained, the width of cut of the harvester in m, neglecting turning losses, is

- (A) 0.71
- (B) 1.07
- (C) 1.78
- (D) 2.96

Q32) In a disc clutch, the inside and outside radii of the clutch plate are 50 and 100 mm, respectively. If the axial force exerted on the disc is 4 kN, the maximum pressure experienced by the clutch plate in Nmm^{-2} under uniform wear conditions is

- (A) 0.13
- (B) 0.17
- (C) 0.25
- (D) 0.51

Q33) Flow is taking place through a layered soil system, having two homogeneous soils M and N, as shown in the figure. The head lost in soil N is 20 times the head lost in soil M.



If the permeability of soil M is $3 \times 10^{-4} \text{ mm s}^{-1}$, the permeability of soil N, in mm s^{-1} , will be

- (A) 4×10^{-4}
- (B) 3×10^{-4}
- (C) 2.5×10^{-5}
- (D) 1.5×10^{-5}

Q34) A trapezoidal canal, having a bottom width of 5.0 m and a side slope of 1 H : 1 V, is carrying a discharge of $20 \text{ m}^3\text{s}^{-1}$. The critical depth, in m, is

- (A) 1.09
- (B) 1.18
- (C) 2.12
- (D) 2.62

Q35) A 200 mm well fully penetrates a confined aquifer. After a long period of pumping at a rate of 1400 litres per minute, the drawdowns in the observation wells located at 25 m and 40 m from the pumping well are found to be 2.6 m and 1.9 m, respectively. The transmissivity of the aquifer in $\text{m}^2\text{day}^{-1}$ is

- (A) 190
- (B) 198
- (C) 206
- (D) 215

Q36) Match the processes given in Group-I with the derived products given in Group-II

Column I	Column II
i. Transesterification	a. Producer gas
ii Pyrolysis	b. Ethanol
iii. Yeast fermentation	c. Biogas
iv. Anaerobic digestion	d. Biodiesel

- (A) i-a; ii-c; iii-b; iv-d
- (B) i-d; ii-c; iii-b; iv-a
- (C) i-b; ii-d; iii-a; iv-c
- (D) i-d; ii-a; iii-b; iv-c

Q37) The pitch of the chain used in a chain drive motion is 38 mm. If the number of teeth on one of the sprockets is 35, the pitch circle diameter of the sprocket in m is _____.

Q38) A flywheel and clutch assembly weighs 200 N and has a radius of gyration 150 mm. If the engine speed is 3000 rpm, the kinetic energy possessed by the rotating assembly in kJ is _____.

Q39) An imaginary surface obtained by joining the water levels in several observation wells driven in a confined aquifer is known as

- (A) Phreatic surface

- (B) Piezometric surface
- (C) Capillary fringe
- (D) Water table

Q40) With increasing grain height in a deep cylindrical grain bin, the pressure at its base will

- (A) decrease initially and then increase
- (B) increase initially and then decrease
- (C) decrease initially and then remain constant
- (D) increase initially and then remain constant



