Q1) A student reported following arsenic concentrations in water samples:

Arsenic concentration (mg/L)	0.10	0.12	0.20	0.05	0.40	0.30	0.35

Which one of the following is a correct statement about arsenic concentration distribution?
(A) Arsenic concentration distribution is symmetric
(B) Arsenic concentration distribution is positively skewed
(C) Arsenic concentration distribution is negatively skewed
(D) Arsenic concentration is following Weibull distribution

Q2) Specific conductance is used in water analysis to indirectly estimate dissolved solids. The measurements used in the method accounts for
(A) Cations only
(B) All ions
(C) Anions only
(D) Un-ionized species

Q3) Ten litres of the sample was filtered through a membrane filter and the filter was transferred to solid agar media which supports growth of coliform organisms. After incubation at 37^{o} C for 48 hours, the agar plates showed an average of 64 colonies per plate. What was the average concentration of coliform organisms (in Colony Forming Units per unit volume) in the original water sample?
(A) 64 CFU/ml
(B) 640 CFU/ml
(C) 6.4×10^{-3} CFU/ml
(D) 64×10^{-3} CFU/ml

Q4) Reverse Transcriptase Polymerase Chain Reaction is an analytical procedure used in detection of pathogenic microorganisms. Which one of the following statements is NOT correct in this context?
(A) It is used for identifying presence or absence of specific RNA in samples.
(B) It is used only for identifying Corona Viruses, including SARS CoV2 in samples.
(C) It cannot differentiate between viable and inactivated viruses.
(D) It is based on conversion of RNA to DNA followed by DNA amplification

Q5) Consider the following statements

Statement 1: Goodrich method for reservoir routing is based on hydrologic flood routing method.

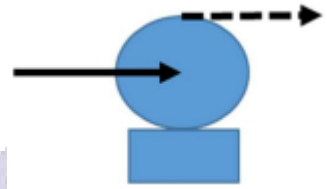
Statement 2: Muskingum method for channel routing is based on hydraulic flood routing method.

Which one of the following is correct?
(A) Statement 1 is false; Statement 2 is false
(B) Statement 1 is true; Statement 2 is false
(C) Statement 1 is true; Statement 2 is true
(D) Statement 1 is false; Statement 2 is true

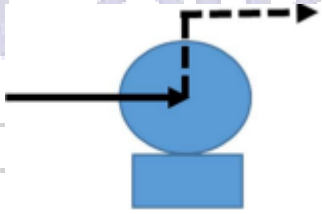
Q6) The correct order of hydraulic conductivity for the geologic formations is
(A) Aquifer > Aquitard > Aquiclude > Aquifuge
(B) Aquifer < Aquitard < Aquiclude < Aquifuge
(C) Aquitard > Aquifer > Aquifuge > Aquiclude
(D) Aquifer > Aquiclude >Aquitard > Aquifuge

Q7) Centrifugal pumps with suction pipe (shown by solid arrow) and delivery pipe (shown by dotted arrow) are shown in the figures. Choose the option that gives the correct connection

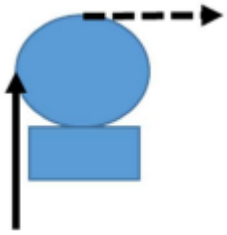
(A)



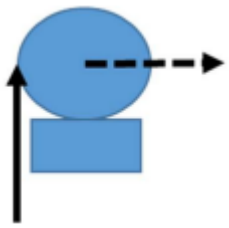
(B)



(C)



(D)



Q8) Carbon dioxide is used in recarbonation process. A solution has 1 mole/L supersaturated calcium carbonate. Estimated amount of carbon dioxide (in grams) needed to completely convert calcium carbonate to calcium ions in 1 litre solution is
(A) 44.000 gram
(B) 0.044 gram
(C) 40.000 gram
(D) 0.040 gram

Q9) A river water sample has pH of 4 and suspended solids concentration of 100 mg/L. If, alum is chosen as a coagulant, what will be the coagulation mechanism?
(A) Ionic layer compression only
(B) Sweep coagulation and Polymer bridging
(C) Polymer bridging only
(D) Charge neutralisation, surface adsorption, ionic layer compression

Q10) Which one of the following is most commonly used raw material in flue gas desulfurization units?
(A) Limestone
(B) Titanium Oxide
(C) Fenton reagent
(D) Beryllium Oxide

Q11) Leachate generated from a legacy municipal solid waste dumping site has to be collected and managed carefully. Which one of the following statements is correct in the context of treatment of leachate from such a site?
(A) Settling chamber followed by micro-filtration units are required.
(B) Modular treatment units targeting dissolved organic matter and salts are required.
(C) Only biological treatment units like ASP with extended aeration are required.
(D) Only a combination of anaerobic-aerobic treatment units is required.

Q12) Which one of the following statements is correct regarding Global warming?
(A) Water vapour does not contribute to global warming.
(B) Global warming is likely to increase the productivity of plants due to CO_2 fertilisation.
(C) CFCs do not cause global warming, but can cause ozone layer depletion in the stratosphere.
(D) HFCs and HCFCs are good substitutes for the ozone depleting substances as they cause neither global warming nor ozone layer depletion.

Q13) In the context of ecosystems, which one of the following is NOT a correct statement?
(A) The growth of an organism such as a plant may be dependent on a number of different factors such as sunlight, mineral nutrients (nitrates, phosphates, etc.), etc. Liegib's law states that, growth occurs at the rate permitted by the most limiting factor.
(B) The carrying capacity of a population is determined by its limiting resources. Carrying capacity is the upper limit of an ecosystem up to which it can provide the basic needs to the population under given circumstances.
(C) The Ramsar convention on lakes and backwater systems of International importance is an international treaty for the conservation and sustainable use of lakes and backwater systems. The treaty was signed in 1981 and became effective in 1985.
(D) A Red Data Book contains lists of species whose continued existence is threatened. Species are classified into different categories of perceived risk. Each Red Data Book usually deals with a specific group of animals or plants and fungi.

Q14) Which one of the following statements correctly defines the concept of 'Extended Producer's Responsibility'?
(A) The responsibility of a producer for environmentally sound disposal of the product after the end of its life
(B) The responsibility of a producer for environmentally sound manufacturing process for the product
(C) The responsibility of a producer for environmentally sound management of the product from manufacturing stage until it is sold in the market
(D) The responsibility of a producer for environmentally sound management of the product until the end of its life

Q15) If G represents Gibbs free energy, select the correct statement(s)
(A) If $\Delta G = 0$, reaction will proceed only in one direction
(B) If $\Delta G = 0$, reaction will be in equilibrium
(C) If $\Delta G < 0$, reaction will proceed forward
(D) If $\Delta G > 0$, reaction will not proceed forward

Q16) For effluents generated by a molasses based distillery and wood based pulp and paper industry, which of the following statement(s) is/are NOT correct?
(A) Both the effluents have dark colour.
(B) Both the effluents have high toxicity.
(C) Both the effluents generally have BOD greater than 15,000 ppm.

(D) Both the effluents have high pH.

Q17) $PM_{2.5}$ concentrations in ambient air can be measured using
(A) Beta attenuation method
(B) Chemiluminescence method
(C) Gravimetric method
(D) Non dispersive infrared spectroscopy method

Q18) Biodegradable wastes like vegetable peelings from kitchen are usually processed by composting techniques. Which of the following option(s) regarding the processing of biodegradable wastes is/are correct?
(A) Vermi-composting is relatively faster than windrow composting, however vermicomposting is not frequently used on large commercial scale.
(B) The windrow height should be as short as possible as large windrow height may cause compaction due to the self-weight.
(C) The windrow height should be as large as possible as that will help to ensure appropriate temperature within the windrow.
(D) Earthworms facilitate the growth of microorganisms and break down complex organic molecules to simpler ones using enzymatic secretions.

Q19) As per 'Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 of Govt. of India, the import of hazardous and other wastes from any country shall NOT be permitted for which of the following option(s)?
(A) Recovery, reuse and recycle
(B) Disposal in abandoned mines
(C) Safe disposal in engineered landfills
(D) Utilisation, including co-processing

Q20) The Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India has published the Environment Impact Assessment (EIA) draft Notification 2020, intended to replace the existing EIA Notification, 2006 under the Environment (Protection) Act, 1986. Which of the following is/are the key change(s) from existing regulation?
(A) Removal of several project/ activities from the purview of public consultation.
(B) A list of projects has been included under Category B2, expressly exempted from the requirement of an EIA.
(C) All the project related activities are brought under the purview of necessary public consultation.
(D) A list of projects has been included under Category B2, bringing them under the

requirement of detailed EIA.

Q21) Which one of the following statements is NOT correct with respect to a batch reactor?
(A) No reactant is added after the reactor has started operation.
(B) No product is withdrawn during the course of the reactor operation.
(C) The reactor operates under steady state.
(D) The reactor operation is carried out for a pre-specified duration.

Q22) A bag filter is used for removal of particulate matter having a range of sizes. The correct sequence of air filtration mechanisms for their removal, in order of decreasing size, is
(A) Diffusion, Impaction, Disintegration
(B) Disintegration, Impaction, Interception
(C) Diffusion, Impaction, Interception
(D) Impaction, Interception, Diffusion

Q23) A typical plasmid-free bacterial cell having a single chromosome consists of ~55% protein, ~3% DNA and ~21% RNA, where "%" represents percentage of dry weight. Assuming there are 2500 different types of protein molecules (with at least one copy number) being expressed in a living bacterial cell at any given time, which of the following statement(s) is/are NOT correct with respect to the number of intracellular DNA, RNA and protein molecules?
(A) DNA = RNA = Protein $\geq$ 2500
(B) DNA = RNA = 1; Protein $\geq$ 2500
(C) DNA = 1; RNA = Protein $\geq$ 2500
(D) DNA = 1; RNA > Protein $\geq$ 2500

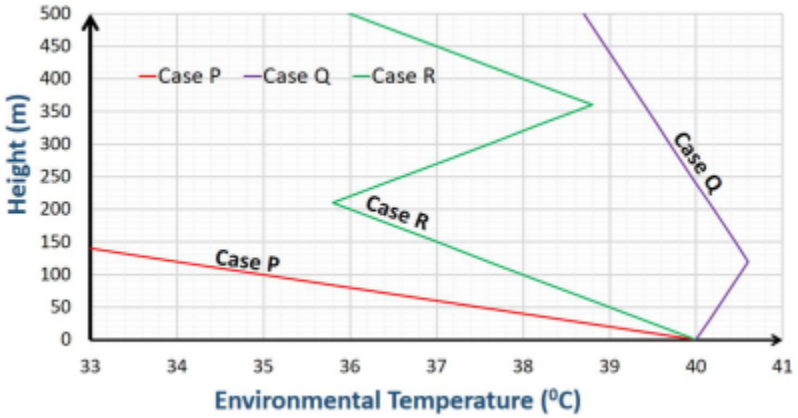
Q24) Average values of the re-aeration rate constant for river X and river Y are 0.92 per day and 1.12 per day, respectively. Average de-oxygenation rate constants for the same rivers are 0.23 per day and 0.35 per day respectively. Then, which of the following statement(s) is/are correct?
(A) Self-purification capacity of river Y is more than that of river X.
(B) Self-purification capacity of river X is more than that of river Y.
(C) River Y has higher turbulence and/or higher velocity and/or higher algal growth compared to river X.
(D) Pollutants in river X are more biodegradable than that in river Y.

Q25) Which of the following statement(s) is/are NOT correct while comparing continuously stirred tank reactor (CSTR) and plug flow reactor (PFR)?
(A) CSTR and PFR are normally operated under steady state condition.
(B) There is complete homogeneity in the CSTR while there are concentration variations

within the PFR.
(C) The overall reaction carried out in a PFR is always higher than that in a CSTR for same total volume.
(D) Reaction kinetics do not play any role in choosing between a CSTR and PFR.

Q26) According to the National Ambient Air Quality Standards (Central Pollution Control Board, Govt. of India, notification 2009) which of the following statement(s) is/are correct?
(A) SO_2 and NO_2 have annual average standards; while O_3 and CO have eight hour average standards.
(B) SO_2 and CO have annual average standards; while O_3 and NO_2 have eight hour average standards.
(C) SO_2 and CO have eight hour average standards; while O_3 and NO_2 have hourly average standards.
(D) SO_2 and NO_2 have 24 hour average standards; while O_3 and CO have hourly average standards.

Q27) Consider the figure shown below for three different cases:



Which of the following statement(s) is/are correct for surface level emissions, given the environmental temperature?
(A) Case P represents unstable atmosphere and results in higher dispersion of emissions.
(B) Case Q represents subsidence inversion and results in higher dispersion of emissions than Case P.
(C) Case Q represents elevated inversion and results in lower dispersion of emissions than Case P.
(D) Case R represents subsidence inversion and results in lower dispersion of emissions than Case P.

Q28) As per the Solid Waste Management Rules of 2016 (Govt. of India), which of the following statement(s) is/are correct?
(A) Biodegradable wastes should be processed biologically preferably in decentralised facilities at the sources of generation.
(B) Biodegradable wastes should be processed biologically preferably in centralised facilities away from the sources of generation.
(C) Used sanitary pads and napkins should be wrapped and disposed into the domestic hazardous waste containers.
(D) Non-biodegradable components with a heat content more than 1500 kcal/kg should be used for power generation or Refuse Derived Fuel (RDF) manufacture.

Q29) Carbon cycle, nitrogen cycle and phosphorus cycle play important role in the ecosystems. Which of the following statement(s) is/are NOT correct about the phosphorus cycle?
(A) Shortage of phosphorus can be a limiting factor in many ecosystems, however, its excess can stimulate eutrophication.
(B) Organic phosphates exist in various rock and soil minerals.
(C) Like carbon cycle, phosphorus also has a gaseous phase and can move into far away ecosystems.
(D) Human interventions like application of phosphorus fertilisers cause much phosphorus to get into the ocean.

Q30) Which of the following statement(s) is/are correct regarding National Green Tribunal (NGT) of India?
(A) NGT Act 2010 draws inspiration from the India's constitutional provision of Article 21 - Protection of life and personal liberty, which assures the citizens of India the right to a healthy environment.
(B) A retired Judge of the Supreme Court, can be the Chairperson of the NGT.
(C) NGT Act 2017 is based on the India's constitutional provision of Article 361 - Protection of Biodiversity and Environmental Protection, which bestows the citizens of India with a duty to protect all abiotic and biotic components of the environment.
(D) The NGT is mandated to make and endeavour for disposal of applications or appeals finally within 45 days of filing of the same.

Q31) An individual has four different email accounts. 60% of emails come into his corporate account, 30% come into his gmail account and the remaining 10% are equally divided into his yahoo and zoho accounts. Only 1% of the emails in his corporate accounts are spam, whereas corresponding percentages for gmail, yahoo and zoho accounts are 2%, 3% and 3%, respectively. Assuming that the same spam filter is used in all the four email accounts, the probability (in

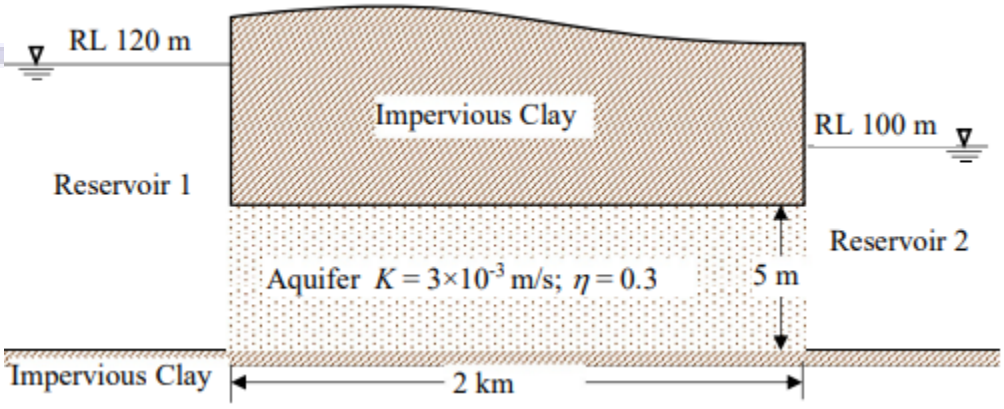
percentage, rounded off to one decimal place) of having a randomly selected email as spam is _____

Q32) An isolated storm of 3 hours occurred over a catchment area in the following manner

% Catchment Area	∅ -index (cm/hour)	Rainfall (cm)		
		1st hour	2nd hour	3rd hour
15	0.5	0.4	2.5	1.6
35	1.0	0.8	3.0	2.1
50	0.8	0.6	2.6	1.9

Total rainfall excess (in cm, rounded off to one decimal place) over the catchment for the above storm is _____.

Q33) Two reservoirs having a difference of 20 m in their water surface elevations are connected through a confined aquifer (thickness = 5 m, length = 2 km, hydraulic conductivity $K = 3 \times 10^{-3}$ m/s, and porosity = 0.3) as shown in the following figure (drawn not to scale).

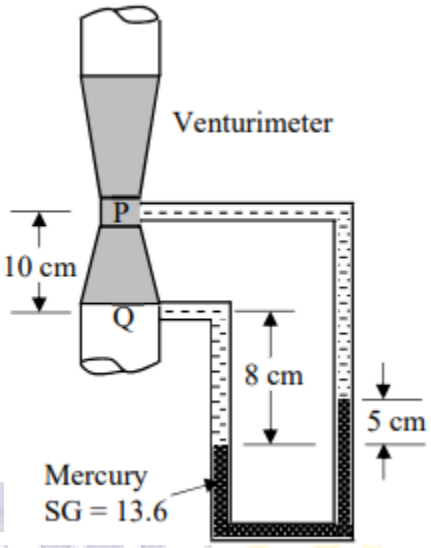


If the Reservoir 1 is contaminated by a pollutant then the time (in days, rounded off to one decimal place) taken by the pollutant to reach to the Reservoir 2 under advection will be _____.

Q34) The depth of flow (in m, rounded off to two decimal places) in a hydraulically efficient rectangular channel (n = 1/80) to carry a discharge of 64 m^3/s at bed slope 0.01 is _____.

Q35) A sewage treatment plant with a capacity of 10 million litres per day (MLD) is treating the sewage through an aerobic biological process. The inlet and outlet BOD are measured as 100 and 30 mg/l, respectively. If the mixed microbial culture has an observed biomass yield of 0.5 g Volatile Suspended Solids (VSS)/g BOD, the sludge production rate (in kg per day, rounded off to one decimal place) when the plant is operating at 80% capacity will be _____.

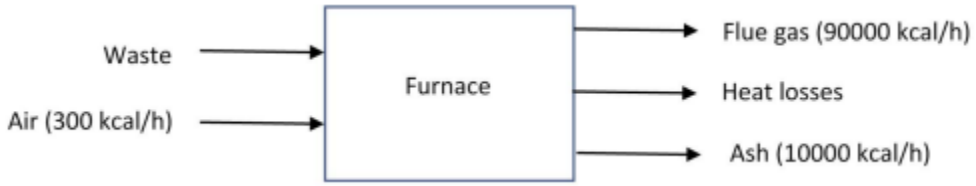
Q36) A venturimeter along with a differential manometer was installed to measure flow in a water pipeline as shown in the following figure (not drawn to scale).



Taking specific weight of water as 9810 N/m^3, the pressure difference (in Pa, rounded off to one decimal place) between point Q and P is _____.

Q37) Two reservoirs having a difference of 10 m in their water surface elevations are connected by a pipeline (diameter = 10 cm, length = 50 m, and friction factor f = 0.02). If the last 25 m length of the pipeline is replaced by a same material pipe of diameter 20 cm then neglecting minor losses the discharge (in %, rounded off to one decimal place) will increase by _____.

Q38) Figure below gives the heat inflow into the furnace of a waste-to-energy plant along with the heat outflows from the furnace.



Assume: (i) total heat loss equal to 3% of heat released while burning waste, (ii)

sensible heat of the waste is negligible, (iii) complete burning of the waste is ensured. If the waste feed rate into this plant is 70 kg/h, the heat content of the waste (in kcal/kg, rounded off to one decimal place) is _____.

Q39) A centrifuge is processing 1000 litres per hour of water containing 2 g per litre of suspended solids. The thickened slurry coming out of the centrifuge has solids concentration of 20 g per 100 ml. If the centrifuge has 99% efficiency based on solids separation, the flow rate (in litres per hour, rounded off to one decimal place) of the supernatant stream will be _____.

Q40) A solution has 0.001 mole/L zinc ions having pH of 6. Solubility product of zinc hydroxide is given as 8×10^{-18} $(mole/L)^3$. Ignoring activity corrections, the ratio (rounded off to two decimal places) of reaction coefficient to solubility product would be _____.