

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
Written Test for the Post of Technical Superintendent at ESED
(Job Reference Number 50690424)

23.06.2026

Duration: 3 hours

Maximum Marks: 75



GENERAL INSTRUCTIONS

1. Read the questions carefully and answer.
2. No clarification shall be sought on the question paper.
3. No mobile phone is permitted
4. All questions are compulsory

Section A: (59 marks): Questions are of multiple-choice type. Only one option is correct in each question and there is no negative marking.

Q.1	In the context of air quality, PM _{2.5} refers to _____.	[1 Mark]
(A)	particles with aerodynamic diameter less than or equal to 2.5 mm	
(B)	particles with aerodynamic diameter greater than or equal to 2.5 mm	
(C)✓	particles with aerodynamic diameter less than or equal to 2.5 µm	
(D)	particles with aerodynamic diameter greater than or equal to 2.5 µm	
Q.2	The major components of biogas are _____.	[1 Mark]
(A)	N ₂ and O ₂	
(B)	CO ₂ and O ₂	
(C)	CH ₄ and H ₂ S	
(D)✓	CO ₂ and CH ₄	
Q.3	In the context of water quality, BOD is exerted by _____.	[1 Mark]
(A)✓	biodegradable organic matter only	
(B)	biodegradable and non-biodegradable organic matter	
(C)	inorganic salts	
(D)	OH ⁻ ions	
Q.4	Which of the following is the largest reservoir of Nitrogen?	[1 Mark]
(A)	Lithosphere	
(B)✓	Atmosphere	
(C)	Biosphere	
(D)	Hydrosphere	
Q.5	The term 'eutrophication' is defined as _____.	[1 Mark]
(A)	processing of wastewater	
(B)	neutralising of wastewater	
(C)✓	enriching of nutrients in water	
(D)	purification of water through natural systems	

Q.6	Which of the following atmospheric gases is the most abundant naturally occurring greenhouse gas?	[1 Mark]
(A)	Carbon Dioxide (CO ₂)	
(B)	Methane (CH ₄)	
(C) ✓	Water Vapour (H ₂ O)	
(D)	Nitrous Oxide (N ₂ O)	
Q.7	If the H ⁺ ions concentration in a very dilute water sample is 10 ^{-6.5} mol L ⁻¹ , then the pH of this water sample is _____.	[1 Mark]
(A)	-6.5	
(B)	6	
(C) ✓	6.5	
(D)	7.5	
Q.8	Which ONE of the following parameters is NOT estimated as part of the proximate analysis of municipal solid waste?	[1 Mark]
(A)	Ash content	
(B)	Moisture content	
(C)	Volatile matter	
(D) ✓	Carbon to nitrogen ratio	

Q.9	In which ONE of the following unit processes of conventional municipal wastewater treatment is most of the dissolved organic matter removed?	[1 Mark]
(A)	Grit Chamber	
(B)	Primary Settling Tank	
(C) ✓	Activated Sludge Process	
(D)	Chlorination	
Q.10	The primary function of a catalytic converter in an internal combustion engine is _____.	[1 Mark]
(A)	increasing engine's power output	
(B)	improving fuel efficiency	
(C)	cooling the engine during operation	
(D) ✓	reducing emissions of harmful gases	
Q.11	Which ONE of the following options does NOT list primary producers?	[1 Mark]
(A)	Algae	
(B)	Cyanobacteria	
(C) ✓	Fungi	
(D)	Plants	
Q.12	Which ONE of the following is considered as renewable energy source?	[1 Mark]
(A) ✓	Biogas	
(B)	Coal	
(C)	Diesel	
(D)	Liquid Petroleum Gas	

Q.13	The tendency of pollutants to concentrate in successive trophic levels is called _____.	[1 Mark]
(A)	Bioremediation	
(B)✓	Biomagnification	
(C)	Biopiracy	
(D)	Biorhythm	
Q.14	Which ONE of the following options lists the prokaryotic organisms?	[1 Mark]
(A)✓	Blue-green algae	
(B)	Green algae	
(C)	Fungi	
(D)	Protozoa	
Q.15	Which ONE of the following is the terminal electron acceptor in the electron transport chain during aerobic respiration?	[1 Mark]
(A)	CO ₂	
(B)✓	O ₂	
(C)	H ₂ O	
(D)	CH ₄	
Q.16	Which ONE of the following does NOT contain any genetic material (i.e. DNA or RNA)?	[1 Mark]
(A)	Algae	
(B)	Archaea	
(C)✓	Prion	
(D)	Virus	
Q.17	Catabolism results in the _____.	[1 Mark]
(A)	formation of ADP from ATP	
(B)✓	formation of ATP from ADP	
(C)	formation of protein from amino acid	
(D)	formation of lipid from fatty acid	

Q.18	Pathogenic _____ cause malaria.	[1 Mark]
(A)	Fungi	
(B)✓	Protozoa	
(C)	Bacteria	
(D)	Virus	
Q.19	Which ONE of the following options lists the CORRECT sequence of growth phases of a population of bacteria in a nutrient rich medium?	[1 Mark]
(A)	lag phase → stationary phase → log phase → decline phase	
(B)	log phase → decline phase → stationary phase → lag phase	
(C)	log phase → stationary phase → lag phase → decline phase	
(D)✓	lag phase → log phase → stationary phase → decline phase	
Q.20	An organism using the oxidation of Fe^{2+} as its energy source, and CO_2 as its carbon source is called as _____.	[1 Mark]
(A)	Photoautotroph	
(B)✓	Chemoautotroph	
(C)	Photoheterotroph	
(D)	Chemoheterotroph	
Q.21	In a double helix DNA, which ONE of the following pairing of nucleotide bases is present?	[1 Mark]
(A)✓	Adenine – Thymine	
(B)	Cytosine – Adenine	
(C)	Thymine – Cytosine	
(D)	Uracil – Thymine	
Q.22	Gram-positive bacteria have a thick layer of _____ in their cell wall.	[1 Mark]
(A)	chlorophyll	
(B)	Lipopolysaccharide	
(C)	mycolic acid	
(D)✓	Peptidoglycan	

Q.23	Which ONE of the following is NOT a coenzyme?	[1 Mark]
(A) ✓	Adenosine Triphosphate	
(B)	Biotin	
(C)	Flavin adenine dinucleotide	
(D)	Nicotinamide adenine dinucleotide	
Q.24	Transcription refers to the flow of genetic information _____.	[1 Mark]
(A)	from DNA to DNA	
(B) ✓	from DNA to RNA	
(C)	from RNA to protein	
(D)	from RNA to lipid	
Q.25	The creation of recombinant DNA starts with the application of _____ enzyme.	[1 Mark]
(A)	Amylase	
(B)	DNA ligase	
(C)	Kinase	
(D) ✓	restriction endonuclease	
Q.26	Which ONE of the following occurs during nitrification process?	[1 Mark]
(A) ✓	NH_4^+ is converted to NO_2^-	
(B)	NO_2^- is converted to NH_4^+	
(C)	NO_3^- is converted to N_2	
(D)	NH_4^+ is converted to NH_3	
Q.27	Which ONE of the following options is NOT a mechanism of horizontal gene transfer?	[1 Mark]
(A)	Conjugation	
(B)	Transduction	
(C) ✓	Translation	
(D)	Transformation	

Q.28	The normality of 1 M solution of H_3PO_4 is _____.	[1 Mark]
(A)	1 N	
(B)	2 N	
(C)	2.5 N	
(D) ✓	3 N	
Q.29	What is the oxidation number of N in NO_3^- ?	[1 Mark]
(A)	-3	
(B)	+2	
(C)	+3	
(D) ✓	+5	
Q.30	What is the atomic weight of nitrogen?	[1 Mark]
(A)	12 g mol ⁻¹	
(B) ✓	14 g mol ⁻¹	
(C)	16 g mol ⁻¹	
(D)	19 g mol ⁻¹	
Q.31	Molality is defined as _____.	[1 Mark]
(A) ✓	$\frac{\text{moles of solute}}{\text{mass of solvent (in kg)}}$	
(B)	$\frac{\text{mass of solute (in kg)}}{\text{mass of solvent (in kg)}}$	
(C)	$\frac{\text{moles of solute}}{\text{volume of solution (in L)}}$	
(D)	$\frac{\text{mass of solute}}{\text{volume of solution (in L)}}$	
Q.32	Alkenes contain _____.	[1 Mark]
(A)	single bonds (C – C) only	
(B) ✓	at least one double bond (C = C) and no triple bond (C ≡ C)	
(C)	at least one triple bond (C ≡ C) and no double bond (C = C)	
(D)	one triple bond (C ≡ C) and one double bond (C = C)	

Q.33	A reversible reaction occurring in a very dilute solution is given as: $2A + 3B \rightleftharpoons C + 2D$. The equilibrium constant K for this reaction can be written as _____.	[1 Mark]
(A)	$K = \frac{2[C][D]}{6[A][B]}$	
(B) ✓	$K = \frac{[C][D]^2}{[A]^2[B]^3}$	
(C)	$K = \frac{6[A][B]}{2[C][D]}$	
(D)	$K = \frac{[A]^2[B]^3}{[C][D]^2}$	
Q.34	A chemical reaction is given as: $Cl_2 + 2Fe^{2+} \rightarrow 2Cl^- + 2Fe^{3+}$. This can be divided into two half-reactions: (1) $Cl_2 + ne^- \rightarrow 2Cl^-$ (2) $2Fe^{2+} \rightarrow ne^- + 2Fe^{3+}$ What is the value of n in these reactions?	[1 Mark]
(A)	1	
(B) ✓	2	
(C)	3	
(D)	4	

Q.35	Which ONE of the following options represents the carboxyl group?	[1 Mark]
(A)	$-OH$	
(B)	$-CN$	
(C)	$-CHO$	
(D)✓	$-COOH$	
Q.36	For what value of k , do the equations $2x - y + 3 = 0$ and $6x - ky + 9 = 0$ represent coincident lines?	[1 Mark]
(A)	2	
(B)	-2	
(C)✓	3	
(D)	-3	
Q.37	If one root of $x^2 - 7x + 10 = 0$ is 5, then the other root is _____.	[1 Mark]
(A)✓	2	
(B)	3	
(C)	5	
(D)	10	
Q.38	The height of a tower is 50 m. The angle of elevation from a point on the ground to the top of the tower is 30° . The distance of the point from the base of the tower is _____.	[1 Mark]
(A)✓	$50\sqrt{3}$ m	
(B)	100 m	
(C)	50 m	
(D)	$25\sqrt{3}$ m	
Q.39	The degree of the polynomial $3x^4 - 7x^3 - 4x - 2$ is _____.	[1 Mark]
(A)	3	
(B)✓	4	
(C)	1	
(D)	2	

Q.40	For a right angle triangle with 'a' as height, 'b' as base, and 'c' as hypotenuse; the Pythagorean Theorem can be expressed as _____.	[1 Mark]
(A)	$c = a^2 + b^2$	
(B)	$c^2 = a + b$	
(C)	$c^2 = a^2 - b^2$	
(D)✓	$c^2 = a^2 + b^2$	
Q.41	What is the value of $\sin 60^\circ$?	[1 Mark]
(A)	$\frac{1}{2}$	
(B)✓	$\frac{\sqrt{3}}{2}$	
(C)	$\frac{1}{\sqrt{2}}$	
(D)	$\frac{\sqrt{2}}{2}$	
Q.42	What is the area of a circle with a circumference of 24π cm?	[1 Mark]
(A)	$36\pi \text{ cm}^2$	
(B)✓	$144\pi \text{ cm}^2$	
(C)	$64\pi \text{ cm}^2$	
(D)	$96\pi \text{ cm}^2$	
Q.43	Which of the following is responsible for depletion of ozone layer?	[1 Mark]
(A)	O_2	
(B)	DDT	
(C)✓	CFC	
(D)	O_3	
Q.44	The force with which a body of mass 1 Kg is attracted by the earth is equal to _____.	[1 Mark]
(A)✓	9.8 N	
(B)	6.67×10^{11}	
(C)	1 N	
(D)	9.8 m/s	

Q.45	The quantity of heat that changes the unit mass of liquid completely into a gas at its boiling point without any change in its temperature is called its _____.	[1 Mark]
(A) ✓	latent heat of vaporization	
(B)	latent heat of fusion	
(C)	latent heat of pressure	
(D)	none of these	
Q.46	The heat energy required to raise the temperature of an entire object by 1°C is called its _____.	[1 Mark]
(A)	specific heat	
(B) ✓	thermal capacity	
(C)	temperature gradient	
(D)	water equivalent	
Q.47	Water stored (and not being released) in a dam has _____.	[1 Mark]
(A)	rotational energy	
(B)	vibrational energy	
(C)	kinetic energy	
(D) ✓	potential energy	
Q.48	When an object falls from height h_1 to h_2 ($h_1 > h_2$), its potential energy changes from U_1 to U_2 . What is the relation between U_1 and U_2 ?	[1 Mark]
(A) ✓	$U_1 > U_2$	
(B)	$U_1 = U_2$	
(C)	$U_1 < U_2$	
(D)	$U_1 \leq U_2$	

Q.49	What is the distance travelled by a train which has an initial velocity of 10 m/s, accelerating at 1m/s^2 for 20s?	[1 Mark]
(A)	200 m	
(B) ✓	400 m	
(C)	240 m	
(D)	400 m^2	
Q.50	The internal energy of a system _____ in an isothermal process.	[1 Mark]
(A)	Increases	
(B)	Decreases	
(C) ✓	remains constant	
(D)	reaches infinity	
Q.51	Which ONE of the following options CORRECTLY lists the concept of entropy and its relationship with the second law of thermodynamics?	[1 Mark]
(A)	Entropy is a measure of temperature, and the second law states that the temperature of an isolated system tends to decrease over time.	
(B)	Entropy is a measure of pressure, and the second law states that the pressure of an isolated system tends to increase over time.	
(C)	Entropy is a measure of internal energy, and the second law states that the internal energy of an isolated system tends to decrease over time.	
(D) ✓	Entropy is a measure of disorder, and the second law states that the entropy of an isolates system tends to increase over time.	
Q.52	A person can swim in still water with a speed of 15 km h^{-1} . If the speed of the stream is 3 km h^{-1} , what will be the time taken by the person to go to 36 km upstream?	[1 Mark]
(A)	2 hours	
(B)	2 hours 30 min	
(C) ✓	3 hours	
(D)	3 hours 30 mins	

Q. 53	What should be the first action when a chemical spill occurs in a laboratory?	[1 Mark]
(A)	Immediately start cleaning the spill	
(B) ✓	Notify nearby personnel and assess the hazard	
(C)	Flush the spill with water immediately	
(D)	Leave the laboratory immediately after starting the fan in full speed	
Q. 54	Which of the following items are typically found in a laboratory chemical spill kit?	[1 Mark]
(A)	Fire extinguisher only	
(B) ✓	Absorbent materials, neutralizers, and personal protective equipment	
(C)	Distilled water bottles	
(D)	Glassware cleaning brushes and dilute acid	
Q. 55	Which environmental condition is most likely to increase the rate of spread of a field fire?	[1 Mark]
(A)	High humidity and light winds	
(B)	Damp vegetation and cloudy weather	
(C) ✓	Strong winds, low humidity, and dry vegetation	
(D)	Recent rainfall and saturated soil	
Q. 56	Choose the sentence that is grammatically correct	[1 Mark]
(A)	Neither the Dean nor the Heads of Departments has attended the meeting	
(B) ✓	Neither the Dean nor the Heads of Departments have attended the meeting	
(C)	Neither the Dean nor the Heads of Departments are attending the meeting yesterday	
(D)	Neither the Dean nor the Heads of Departments has been attended the meeting	

Q. 57	No sooner _____ the notification issued than several representations were received from stakeholders	[1 Mark]
(A)	Was	
(B)	Had been	
(C) ✓	Had	
(D)	Has been	
Q. 58	During the practical examination, the laboratory assistant had to learn the ropes before independently handling sophisticated equipment. The idiom " learn the ropes " means	[1 Mark]
(A)	Learn how to tie laboratory cables	
(B) ✓	Understand the basic procedures and skills of a job	
(C)	Repair damaged equipment	
(D)	Memorize laboratory rules	
Q. 59	A department receives a grant for procurement of laboratory equipment. Which of the following functions is typically performed by a Technical Superintendent?	[1 Mark]
(A)	Approving the budget allocation independently	
(B) ✓	Preparing technical specifications, evaluating technical suitability, and assisting procurement committees	
(C)	Sanctioning purchase orders directly to vendors	
(D)	Conducting financial audits	
Section-B: 16 Marks (Each question is of 2 marks)		
Q.60	What is the alkalinity of a water sample (in mg L ⁻¹ as CaCO ₃) having 305 mg L ⁻¹ of HCO ₃ ⁻ and 150 mg L ⁻¹ of HCO ₃ ²⁻ ions? Atomic weights (g mol ⁻¹) are: H = 1, C = 12; O = 16, Ca = 40.	[2 Marks]
	Type text here 500 mg/L	

Q.61	What is the ionic strength of a 0.2 M solution of MgSO_4 ? Assume complete dissociation of the salt in aqueous solution.	[2 Marks]
	0.8 M	
Q.62	The sum of the first 10 terms of the Arithmetic Progression: 2, 4, 6, 8, ... is _____. Type text here	[2 Marks]
	110	
Q.63	The distance between the points (3, 4) and (6, 8) is _____. Type text here	[2 Marks]
	5	
Q.64	The smallest number which when divided by 6, 8, and 12 leaves remainder 5 in each case is _____. Type text here	[2 Marks]
	29	

Q. 65	The value of $0.001 \times 1000 \div 0.01 + 2500$ is Type text here 2600	[2 Marks]
Q. 66	The cost of an equipment is rupees 15 Lakh. If the vendor offers 10% overall discount, 3% per year maintenance charges of the final cost of the equipment and 2% of the yearly maintenance charges for mandatory one-time staff training. The total amount paid to the vendor including maintenance and staff training for a period of 3 years (in Lakh rupees) is Type text here Cost of equipment = $15 - 0.1 \times 15 = 13.5$ Lakh Maintenance per year = $13.5 \times 0.03 = 0.405$ Lakh Staff training = Rupees 810 Total: 14.7231 Lakh	[2 Marks]
Q. 67	In a laboratory course, a student repeats an experiment five time and obtains the values of measured property as 24, 26, 25, 27 and 24, the final result to be reported including standard deviation is Type text here 25.2(+/-)1.3	[2 Marks]

=====Paper Ends=====