



# STEM Careers Project



STEM Careers Project is a joint venture of the Higher Education Commission and Pakistan Atomic Energy Commission, for grooming talented students for careers in Science, Technology; Engineering & Mathematics (STEM).

## Screening TEST: Chemistry NSTC-22, June 28, 2025

Maximum Marks: 100

Maximum Time: 3 hours

**Check List: Before attempting this question paper please make sure that:**

- Paper contains 8 pages including this page and no page is torn or missing
- Part I consists of 20 multiple choice questions, Part II contain 50 multiple choice questions and Part III contains descriptive questions
- Answer Sheet for MCQs of Part-I & II, and Part III is to be solved on the question paper to be returned back.


- Part I has 5 multiple-choice questions (MCQs) from each of the subjects of Biology, Computer, Chemistry, Mathematics and Physics. There is a choice between Biology or Computer only, rest of the three subjects are compulsory for every candidate. For Biology or Computer one must blacken the corresponding circle in the answer sheet.
- Part I has 20 MCQs and carries 20 marks. The MCQ portion of the relevant subject of Part II carries 50 Marks. Correct answer carries +1 mark; 1/3 mark will be deducted for each incorrect answer.
- In Part I and Part II, there are four choices (a, b, c, d) corresponding to each multiple-choice question. Blacken one of these choices, which in your opinion is correct. Rough work may be done on the question paper.
- The descriptive question(s) of Part III should be solved on the question paper to be returned back. This part carries 30 Marks.
- You are recommended to give frank opinion about the test, including pointing out possible mistakes and legibility problems on the last page of the Answer Booklet. It is meant to motivate you to carefully read the question paper before attempting it. It may be used to discriminate between candidates having similar scores.
- Recommended time for Part I is about 30 minutes and for Parts II and III is about one hour each. The rest of the time is for carefully reading the paper and commenting on it.
- No leaf from the question paper or Answer Booklet is to be torn out as all these must be handed over to the examiner, even if no question has been attempted. Anyone found using unfair means would be disqualified.
- You may use non-programmable calculators.
- No questions will be entertained and no clarification will be made during the test. In case of doubt, please write down your remarks/comments on the last page of the Answer Booklet.
- You must attempt all Parts of the paper. To qualify screening test one should pass both Parts I and the portion of Parts II and III that are relevant to the discipline in which you have applied to appear.
- The term 'estimate' if used in the descriptive portion of Part II means that only an approximate answer is expected from the students. Similarly the term 'sketch' in Part III means drawing a rough graph, which looks like what you might expect from more careful considerations.
- Possession of CELL PHONE or any IMAGING DEVICE in the Examination Hall will be treated as an offence under unfair mean rules.**
- Please put your pen down as soon as you hear the announcement of 'stop writing'.

Students will be short-listed for a one-week Training Camp on the basis of their performance on this Screening Test. Results will be posted on NSTC web page: [www.stem.edu.pk](http://www.stem.edu.pk). Successful candidates will also be informed about their result in about two months after the exam. Please make sure that we have your correct phone/fax number and e-mail address.

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Name: \_\_\_\_\_

Roll No: \_\_\_\_\_



## PART-I

### [CANDIDATE MUST ATTEMPT THIS PART]

[It contains 20 MCQs, 5 from each biology/computer, chemistry, mathematics and physics, for selection to the next phase]

Choose either Biology or Computer and must blacken the correct option in the answer sheet.

#### BIOLOGY

1. Which gas is filled in an electric bulb?  
a) Argon                      b) Helium                      c) Nitrogen                      d) All of these
2. Cancer is disease of:  
a) Simple cell                      b) Uncontrolled cell                      c) Controlled cell division                      d) Accelerated cell division  
division                      division                      division
3. Which of the following is a list of entirely abiotic factors?  
a) Soil, temperature,                      b) viral infection,                      c) Sunlight, soil pH,                      d) Temperature, soil  
viral infection, pH of                      predators, competition                      number of species,                      pH, oxygen, light  
soil, predators                      for resources                      Plant canopy
4. Malaria is an infectious disease caused by a single-celled eukaryotic organism, carried by female mosquitoes. The mosquito is the:  
a) Pathogen                      b) Vector                      c) Agent                      d) Virus
5. Cellular digestion is associated with which organelle?  
a) Lysosomes                      b) Mitochondria                      c) Golgi bodies                      d) Plastids

**OR**

#### COMPUTER

1. When \_\_\_\_\_ is encountered inside any loop, control automatically passes to the first statement after loop.  
a) Continue                      b) Goto                      c) Return                      d) Break
2. The speed of the laser printer is measured in.  
a) Lines per minute                      b) Page per minutes                      c) Characters per sound                      d) Word per minutes
3. Which unit in the CPU is responsible for fetching instructions from memory?  
a) ALU (Arithmetic Logic Unit)                      b) Register                      c) Cache Memory                      d) Control Unit
4. When a collection of various computers appears as a single coherent system to its clients, what is this called?  
a) mail system                      b) distributed system                      c) networking system                      d) computer network
5. In a hierarchical database model, data is organized in a:  
a) Tree-like structure                      b) Mesh structure                      c) Circular structure                      d) Linear structure

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## CHEMISTRY

6. A mole of any substance is related to?  
a) Number of particles    b) Volume of gaseous substance    c) Mass of a substance    d) All of these
7. A drop of liquid acquires a spherical shape because of:  
a) its tendency to maximize its surface area    b) its tendency to acquire minimum surface area  
c) its viscous nature    d) none of these
8. Some people add sodium chloride to water while boiling eggs. This is to?  
a) decrease the boiling point of water    b) increase the boiling point of water  
c) prevent breaking of eggs    d) make egg tasty
9. A variety of water which contains soluble salts of Ca and Mg is known as:  
a) Soft water    b) Heavy water    (c) Conductivity water    d) Hard water
10. Milk is a colloid in which?  
a) Liquid is dispersed in liquid    b) Gas is dispersed in liquid    c) Sugar is dispersed in water    d) Solid is dispersed in liquid

## MATHEMATICS

11. If  $x + 1/x = 3$ , then the value of  $x^2 + 1/x^2$  is:  
a) 5    b) 7    c) 9    d) 3
12. Find the degree of the polynomial  $5x^4y^2 + 3xy^5 + 7$ ?  
a) 4    b) 6    c) 7    d) 5
13. Number of real roots of  $x^2 + 4x + 5 = 0$  is:  
a) 2    b) 0    c) 1    d) infinite
14. If  $x^2 - 6x + 9 = 0$ , the  $x =$   
a) 0    b) 3    c) 9    d)  $\pm 3$
15. The set of all points, in a plane equidistant from a fixed point  $A = (x, y)$ , forms a  
a) Line    b) Circle    c) Sphere    d) None of these

## PHYSICS

16. A 1,200-kilogram car traveling at 10 meters per second hits a tree and is brought to rest in 0.10 second. What is the magnitude of the average force acting on the car to bring it to rest?  
a)  $1.2 \times 10^2$  N    b)  $1.2 \times 10^4$  N    c)  $1.2 \times 10^3$  N    d)  $1.2 \times 10^5$  N
17. A spring scale reads 20 newtons as it pulls a 5.0-kilogram mass across a table. What is the magnitude of the force exerted by the mass on the spring scale?  
a) 49 N    b) 20 N    c) 5 N    d) 4 N
18. When a neutral metal sphere is charged by contact with a positively charged glass rod, the sphere  
a) loses electrons    b) gains electrons    c) loses protons    d) gains protons
19. A motor is used to produce 4.0 waves each second in a string. What is the frequency of the waves?  
a) 0.25 Hz,    b) 25 Hz,    c) 15 Hz,    d) 4 Hz
20. One watt is equivalent to one  
a) N·m    b) N/m    c) J·s    d) J/s

Name: \_\_\_\_\_

Chemistry

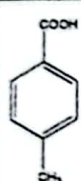
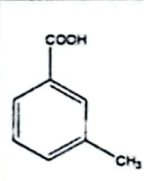
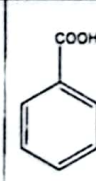
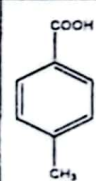
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## PART II – CHEMISTRY

21	Express 145.6 L of chlorine in term of gram moles at STP:						
(a)	6.5 g moles	(b)	4.5 g moles	(c) 0.65 g moles	(d) 9.5 g moles		
22	Which of the following is a non-crystalline solids' pair?						
(a)	show isotropy	(b)	have a sharp melting point	(c)	have anisotropic nature	(d)	have a long-range orderly arrangement
23	SI unit of the coefficient of viscosity of the liquid is:						
(a)	$\text{kg}^{-1} \text{m}^{-2}$	(b)	$\text{g m}^{-1} \text{s}^{-1}$	(c)	$\text{kg m}^{-1} \text{s}^{-1}$	(d)	$\text{kg cm}^{-1} \text{s}^{-1}$
24	An ideal gas obeying kinetic theory of gases can be liquefied, if:						
(a)	$T > T_c$	(b)	$P > P_c$	(c)	$P > P_c$ and $T < T_c$	(d)	it cannot be liquefied at any value of P and T
25	The critical temperature of water is higher than that of $\text{O}_2$ because the $\text{H}_2\text{O}$ molecules has						
(a)	Fewer electron than $\text{O}_2$	(b)	Two covalent bonds	(c)	V-shape	(d)	Dipole moment
26	6.4 g $\text{SO}_2$ at $0^\circ\text{C}$ and 0.99 atm pressure occupies a volume of 2.241 L. Predict which of the following is correct?						
a)	The gas is ideal.						
b)	The gas is real with intermolecular attraction.						
c)	The gas is real without intermolecular repulsion.						
d)	The gas is real with intermolecular repulsion greater than intermolecular attraction.						
27	At what temperature, the rate of diffusion of $\text{N}_2$ would be 1.625 times the rate of effusion of $\text{SO}_2$ at $50^\circ\text{C}$ ?						
(a)	110 K	(b)	173 K	(c)	373 K	(d)	273 K
28	The partial pressure of oxygen in flask containing 16 g $\text{O}_2$ and 32 g $\text{SO}_2$ is:						
(a)	1/16 of total pressure	(b)	1/2 of total pressure	(c)	2/3 of total pressure	(d)	None of these
29	In which orbital the angular momentum of an electron is zero?						
(a)	$2p$	(b)	$2s$	(c)	$3d$	(d)	$4f$
30	A set of isoelectronic species is:						
(a)	$\text{H}_2, \text{CO}_2, \text{CN}^-, \text{O}^-$	(b)	$\text{N}, \text{H}_2\text{S}, \text{CO}$	(c)	$\text{N}_2, \text{CO}, \text{CN}^-, \text{O}_2^{2+}$	(d)	$\text{Ca}, \text{Mg}, \text{Cl}$
31	The correct representation for d orbital is:						
(a)	$(n-1)d^{1-9} ns^1$	(b)	$(n-1)d^{1-10} ns^{1-2}$	(c)	$(n-1)d^{1-5}$	(d)	$(n-1)d^{1-10} ns^2$
32	The ionization energy of hydrogen atom is 13.6 eV. What will be the ionization energy of $\text{He}^+$ ?						
(a)	13.6 eV	(b)	54.4 eV	(c)	122.4 eV	(d)	Zero
33	The incorrect configuration is:						
(a)	$\text{K} = [\text{Ar}] 4s^1$	(b)	$\text{Cr} = [\text{Ar}] 3d^5 4s^1$	(c)	$\text{Cr} = [\text{Ar}] 3d^4 4s^2$	(d)	$\text{Cu} = [\text{Ar}] 3d^{10} 4s^1$
34	3.65 gram of HCl is dissolved in 16.2 grams of water. The mole fraction of HCl in the resulting solution is:						
(a)	0.4	(b)	0.3	(c)	0.2	(d)	0.1
35	Which of the following concentration factor is affected by change in temperature?						
(a)	Molarity	(b)	Molality	(c)	Mole fraction	(d)	Weight fraction
36	The enthalpy change ( $\Delta H$ ) for the reaction $\text{N}_2(g) + 3\text{H}_2(g) \longrightarrow 2\text{NH}_3(g)$ is $-92.38 \text{ kJ}$ at $298 \text{ K}$ . The internal energy change $\Delta U$ at $298 \text{ K}$ is:						
(a)	$-92.38 \text{ kJ}$	(b)	$-87.42 \text{ kJ}$	(c)	$-97.34 \text{ kJ}$	(d)	$-89.9 \text{ kJ}$
37	Identify the correct statement regarding a spontaneous process.						
a)	Endothermic processes are never spontaneous.						
b)	Exothermic process are always spontaneous.						
c)	Lowering of energy in the reaction process is the only criterion for spontaneity.						
d)	For a spontaneous process in an isolated system, the change in entropy is positive.						

38	The equilibrium constant of a reaction is 300. If the volume of the reaction flask is tripled, the equilibrium constant is:						
(a)	300	(b)	600	(c)	900	(d)	100
39	Which of the following is tri-basic acid?						
(a)	H <sub>3</sub> PO <sub>4</sub>	(b)	H <sub>3</sub> PO <sub>3</sub>	(c)	H <sub>3</sub> PO <sub>2</sub>	(d)	HPO <sub>3</sub>
40	Which of the following pairs constitute buffer solution?						
(a)	HCl and KCl	(b)	NaOH and NaCl	(c)	HNO <sub>2</sub> and NaNO <sub>2</sub>	(d)	HNO <sub>3</sub> and NH <sub>4</sub> NO <sub>3</sub>
41	The correct order of relative acidity is:						
(a)	HClO > HClO <sub>2</sub> > HClO <sub>3</sub> > HClO <sub>4</sub>	(b)	HClO <sub>4</sub> > HClO <sub>3</sub> > HClO <sub>2</sub> > HClO	(c)	HClO > HClO <sub>4</sub> > HClO <sub>2</sub> > HClO <sub>3</sub>	(d)	HClO <sub>3</sub> > HClO <sub>2</sub> > HClO <sub>4</sub> > HClO
42	Hydrogen ion concentration in mol/L in solution of pH 5.4 will be:						
(a)	3.88 x 10 <sup>8</sup>	(b)	3.98 x 10 <sup>-6</sup>	(c)	3.98 x 10 <sup>8</sup>	(d)	3.68 x 10 <sup>-6</sup>
43	The standard reduction potential of three metallic cation X, Y and Z are 0.52, -3.03 and -1.18 respectively. The order of reducing power of the corresponding metal is:						
(a)	Y > Z > X	(b)	X > Y > Z	(c)	Z > Y > X	(d)	Z > X > Y
44	For a spontaneous reaction the ΔG, equilibrium constant (K) and E <sup>o</sup> <sub>cell</sub> will be, respectively:						
(a)	-ve, > 1, +ve	(b)	+ve, > 1, -ve	(c)	-ve, < 1, -ve	(d)	-ve, > 1, -ve
45	Unit of rate constant for the first and zero order reaction in terms of molarity M, units are respectively						
(a)	s <sup>-1</sup> , M s <sup>-1</sup>	(b)	s <sup>-1</sup> , M	(c)	M s <sup>-1</sup> , s <sup>-1</sup>	(d)	M, s <sup>-1</sup>
46	For a chemical reaction A → B, the rate of reaction doubles when the concentration of A is increased four times. The order of reaction for A is:						
(a)	Zero	(b)	One	(c)	Two	(d)	Half
47	A colloidal solution of a liquid in a solid is termed as:						
(a)	Aerosol	(b)	Gel	(c)	Emulsion	(d)	Sol
48	Which is not correct regarding the adsorption of a gas on the surface of solid?						
a)	On increasing temperature adsorption increasing continuously.						
b)	Enthalpy and entropy change is -ve.						
c)	Adsorption is more for some specific substance.						
d)	It is a reversible process.						
49	Which of the following oxides are most basics:						
(a)	Bi <sub>2</sub> O <sub>3</sub>	(b)	SeO <sub>2</sub>	(c)	Al <sub>2</sub> O <sub>3</sub>	(d)	Sb <sub>2</sub> O <sub>3</sub>
50	Which of the following ion has the highest value of ionic radius?						
(a)	F <sup>-</sup>	(b)	O <sup>2-</sup>	(c)	B <sup>3+</sup>	(d)	Li <sup>+</sup>
51	A reduction in atomic sizes with increase in atomic number is a characteristic of elements of:						
(a)	radioactive series	(b)	d-block	(c)	f-block	(d)	High atomic masses
52	In which of the following compound will the bond angle be maximum?						
(a)	NH <sub>3</sub>	(b)	NH <sub>4</sub> <sup>+</sup>	(c)	PCl <sub>3</sub>	(d)	SCl <sub>2</sub>
53	The planar structure of BF <sub>3</sub> can be explain by the fact that BF <sub>3</sub> is:						
(a)	sp hybridized	(b)	sp <sup>2</sup> hybridized	(c)	sp <sup>3</sup> hybridized	(d)	sp <sup>4</sup> hybridized
54	Number of P—O bonds in P <sub>4</sub> O <sub>10</sub> are:						
(a)	17	(b)	16	(c)	15	(d)	6
55	The industrial preparation of nitric acid by Ostwald's process involves:						
(a)	Hydrolysis of NH <sub>3</sub>	(b)	Reduction of NH <sub>3</sub>	(c)	Oxidation of NH <sub>3</sub>	(d)	Hydrogenation of NH <sub>3</sub>
56	The molarity of pure water at 277K is:						
(a)	1 M	(b)	5 M	(c)	55.5 M	(d)	2.5 M
57	Ammonia can be dried by:						
(a)	Conc. H <sub>2</sub> SO <sub>4</sub>	(b)	P <sub>4</sub> O <sub>10</sub>	(c)	CaO	(d)	Anhydrous CaCl <sub>2</sub>
58	Which of the following oxide is amphoteric in character?						
(a)	CO <sub>2</sub>	(b)	SiO <sub>2</sub>	(c)	SnO <sub>2</sub>	(d)	CaO
59	Which of the following is most stable?						
(a)	HI	(b)	HCl	(c)	HBr	(d)	HF

60	On heating quick lime with coke in an electric furnace, we get:						
(a)	CaC <sub>2</sub>	(b)	CaCO <sub>3</sub>	(c) CaO	(d) Ca and CO <sub>2</sub>		
61	Alkali metals are characterized by: I. Good conductor of heat and electricity    II. High oxidation potential III. High melting point    IV. Solubility in liquid ammonia						
(a)	I, II	(b)	II, III, IV	(c)	I, II, IV	(d)	All of these.
62	Aniline is usually purified by:						
(a)	Chromatography	(b)	By the addition of oxalic acid	(c)	Fractional crystallization	(d)	Steam distillation
63	The purity of organic compound is determined by:						
(a)	Melting point	(b)	Molecular weight	(c)	Density	(d)	Mixed melting point
64	The IUPAC name of C <sub>6</sub> H <sub>5</sub> COCl is:						
(a)	Benzoyl chloride	(b)	Benzene chloroketone	(c)	Benzene carbonyl chloride	(d)	Chlorophenyl ketone
65	How many stereoisomer are there for tartaric acid (C <sub>4</sub> H <sub>4</sub> O <sub>6</sub> ):						
(a)	3	(b)	4	(c)	5	(d)	0
66	Which one of the following does not have sp <sup>2</sup> hybridized carbon?						
(a)	Acetone	(b)	Acetic acid	(c)	Acetonitrile	(d)	Acetamide
67	Reaction not involve the carbonium is:						
(a)	Aldol condensation	(b)	Claisen condensation	(c)	Pinacol pinacolone rearrangement	(d)	Micheal reaction
68	Anti Markownikoff addition of HBr is not observed in:						
(a)	Propene	(b)	Butane-1	(c)	Pent-2-ene	(d)	But-2-ene
69	Which of the following intermediate has the complete octet around the carbon atom?						
(a)	Free radical	(b)	Carbene	(c)	Carbanion	(d)	Carbonium ion
70	Which is most acidic in nature?						
(a)		(b)		(c)		(d)	

### Part III: Chemistry-Descriptive Questions

[Max points 30: All questions carry equal points]

Question 1: What is greenhouse effect? How is it related to global warming?

Answer:

Name: \_\_\_\_\_

Chemistry

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Roll No: \_\_\_\_\_

Name: \_\_\_\_\_

Roll No: \_\_\_\_\_

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**Question 2:** What are volatile organic compounds (VOCs), and how are they classified chemically?

**Answer :**

**Question 3:** Explain the working of solar panels.

**Answer :**

**Question 4:** How purification of water is made? Explain some methods.

**Answer :**

—End of paper—

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Name: \_\_\_\_\_

Roll No: \_\_\_\_\_