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: Biology
NSTC-20, March 19, 2023

Maximum Marks: 100 Maximum Time: 3 hours

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

i) Paper contains 7 pages including this page and no page is torn or missing
ii) Part I consists of 20 multiple choice questions, Part II contain 50 multiple choice questions and Part III contains descriptive questions
iii) Answer Sheet for MCQs of Part-I & II, and Answer Booklet for Part III

1. 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.
2. 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.
3. Write your name on the space provided in the Answer Sheet for Part I and Part II. There are four choices (a, b, c, d) corresponding to each multiple-choice question. Blacken one of these choices as shown in the example, which in your opinion is correct. Rough work may be done in the Answer Booklet for Part III by clearly specifying 'Rough Work'.
4. The descriptive question(s) of Part III should be solved in the Answer Booklet for Part III. This part carries 30 Marks.
5. You are recommended to give frank opinion about the test, including pointing out possible mistakes on the last page of the Answer Booklet. It is meant to motivate you to carefully read the question paper before attempting. It may be used to discriminate between candidates having similar scores.
6. 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.
7. 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.
8. You may use non-programmable calculators.
9. 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.
10. 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.
11. 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.
12. **Possession of CELL PHONE or any IMAGING DEVICE in the Examination Hall will be treated as an offence under unfair mean rules.**
13. 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. 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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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. During cellular respiration breakdown of glucose occurs in

a) Vacuole b) Golgi complex c) Mitochondria d) Cytoplasm

2. The hypothesis that stands the test of time are called:

a) Law b) Null hypothesis c) Principle d) Theories

3. Cancer is disease of:

a) Simple cell division b) Uncontrolled cell division c) Controlled cell division d) Accelerated cell division

4. A conjugate acid is a specie formed by accepting a

a) Electron pair b) Neutron c) Proton d) Electron

5. In which phase of Meiosis the homologous chromosomes separated from each other

a) prophase 1 b) telophase 1 c) anaphase 1 d) metaphase 1

OR

COMPUTER

1. Internet uses _____ to communicate between devices and networks.

a) HTTPS b) email c) website d) internet protocol suite

2. Which of the following creates user groups and assigns privileges to them?

a) Process management b) I/O management c) File management d) Network management

3. In C++, a pointer is

a) address of a variable b) variable for storing address c) data type of an address variable d) constant value

4. The programming technique where a function calls itself is known as

a) inline function b) encapsulation c) recursion d) it is a bug

5. Which of the following loop is always executed at least once:

a) for b) while c) do while d) counter loop

CHEMISTRY

6. All of the following substance are crystalline except:
a) Ice b) Diamond c) Sucrose d) Plastic

7. Diameter of an atom in the order of
a) 0.2μm b) 0.2mm c) 0.2nm d) 0.2pm

8. Which of the following is not a macromolecule
a) Sand b) Hemoglobin c) Diamond d) Maltose

9 About how many elements in the Periodic Table are Metals
a)60% b) 65% (c) 70% d) 75%

10. Plasma is used in
a) Florescent bulb b) Neon signs c) Laser d) All of these

MATHEMATICS

11. The distance between the points (-2, 2) and (1, 6) is
a) 25 units b) 5 units c) 7 units d) none of these

12. Angles that sum up to 90 ° are known as
a) complementary angles b) vertical angles c) reflective angles d) supplementary angles

13. Total number of lines passing through the point (0,0) are
a) 0 b) 1 c) 2 d) ∞

14. The coordinates of the midpoint of points in plane with coordinates $(-2,8)$ and $(8,-2)$ is
a) (0,0) b) (3,3) c) (2,2) d) (8,8)

15. If $x+\frac{1}{x}=2$, then the value of $x^2+\frac{1}{x^2}$ is:
a) $1/4$ b) 1 c) 3 d) 2

PHYSICS

16. A net force of 10. Newtons accelerates an object at 5.0 m/s^2. What net force would be required to accelerate the same object at 1.0 m/s^2?
a) 1.0 N b) 2.0 N c) 5 N d) 10 N

17. A 1,200-kilogram car traveling at 10. m/s 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) 1.2×10^2 N b) 1.2×10^3 N c) 1.2×10^4 N d) 1.2×10^5 N

18. When a neutral metal sphere is charged by contact with a positively charged glass rod, the sphere
a) loses electrons b) loses protons c) gains electrons d) gains protons

19. An electric iron operating at 120 volts draws 10. Amperes of current. How much heat energy is delivered by the iron in 30 Seconds?
a) 3.0×10^2 J b) 3.6×10^3 J c) 1.2×10^3 J d) 3.6×10^4 J

20. A radar gun can determine the speed of a moving automobile by measuring the difference infrequency between emitted and reflected radar waves. This process illustrates
a) resonance b) diffraction c) the Doppler effect d) refraction

PART II – BIOLOGY

21	The process in which the homologous chromosomes line up with each other and form a pair is called						
(a)	Synapsis	(b)	Bivalent	(c)	Chiasmata	(d)	Crossing over
22	The major component of fungi cell wall is						
(a)	Peptidoglycan	(b)	Cellulose	(c)	Chitin	(d)	Lipid
23	The shrinking of cytoplasm is called						
(a)	Plasmolysis	(b)	Cytolysis	(c)	Cytocompression	(d)	Cytodialation
24	What is the shape of the rings present in trachea?						
(a)	C-shaped cartilaginous	(b)	U-shaped fibrous	(c)	B-shaped cartilaginous	(d)	D-shaped fibrous
25	The main cause of lung cancer include:						
(a)	Water contamination	(b)	Bacterial infection	(c)	Un-sterilized syringe	(d)	Carcinogens
26	The tissues which attach muscles to bones are called?						
(a)	tendons	(b)	ligaments	(c)	Cartilage	(d)	Connective
27	Cartilage and bones are---------- tissues.						
(a)	Ground	(b)	Supporting	(c)	Connective	(d)	Socket
28	Cellular respiration is----------reaction:						
(a)	Physical	(b)	Oxidation-reduction	(c)	Reduction	(d)	Oxidation
29	T and B cells are						
(a)	RBC	(b)	Natural killer cells	(c)	Lymphocytes	(d)	Macrophyes
30	Gaseous exchange in leaf occurs through						
(a)	Lenticles	(b)	Stomata	(c)	Epidermis	(d)	Cuticle
31	The nasal cavity opens into the:						
(a)	Oral cavity	(b)	Larynx	(c)	Nasopharynx	(d)	Lungs
32	The tissues cover the outside of body and lines organs and cavities are called:						
(a)	Connective tissue	(b)	Epithelial tissue	(c)	Muscle tissue	(d)	Epidermis
33	----------are the most abundant species on planet Earth.						
(a)	Human	(b)	Protoza	(c)	Insects	(d)	Bacteria
34	Erythrocytes transport----------?						
(a)	Nerve impulse	(b)	Food	(c)	Water	(d)	Oxygen
35	Which blood vessel contain valves?						
(a)	arteries	(b)	veins	(c)	capillaries	(d)	arterioles
36	Glucagon is produced by:						
(a)	Thyroid glands	(b)	Sweat glands	(c)	Gastric glands	(d)	Pancreas
37	Plants store large amount of water in their cells for:						
(a)	turgidity	(b)	dormancy	(c)	flaccidity	(d)	pollination
38	Despite eating a carb-rich meal, the blood glucose level remains at:						
(a)	1 g/L	(b)	2 g/L	(c)	10 g/L	(d)	20 g/L
39	The trees which shed leaves annually remove ----------from their body.						
(a)	Nutrients	(b)	Oil and bark	(c)	Harmless metabolites	(d)	Excretory products
40	Cells involved in photosynthesis and respiration during day are:						
(a)	Epidermal cells	(b)	Pericycle cells	(c)	Mesophyll cells	(d)	Cortical cells
41	Some gaseous exchange in young stem and leaves occur through:						
(a)	Mid-rib	(b)	Petiole	(c)	Cuticle	(d)	Thalamus
42	----------is the functional unit of environment.						
(a)	Genus	(b)	Ecosystem	(c)	Community	(d)	Biome

43	The alternate form of a gene is called:						
(a)	Allele	(b)	Sister chromosome	(c)	Replicate	(d)	Genovar
44	Expired drugs can cause damage to:						
(a)	Brain	(b)	Kidney	(c)	Heart	(d)	Stomach
45	Spinal cord is the continuation of						
(a)	medulla oblangata	(b)	cerebellum	(c)	hypothlamus	(d)	temporal lob
46	The study of external structural characterization is called:						
(a)	Cytology	(b)	Anatomy	(c)	Histology	(d)	Morphology
47	Peritoneum contains:						
(a)	Somatic and visceral afferent nerves	(b)	Celiac, superior and inferior mesenteric vessels	(c)	Stomach, liver, pancrease	(d)	All of these
48	The study of internal structural characterization is called:						
(a)	Cytology	(b)	Anatomy	(c)	Histology	(d)	Morphology
49	The drugs used to reduce pain are known as:						
(a)	Analgesics	(b)	Antiseptic	(c)	Antibiotic	(d)	Sedative
50	The most rapidly dwindling resource in the world is _____						
(a)	Air	(b)	Water	(c)	Forests	(d)	Sunlight
51	When the platelets count is too high, it can cause:						
(a)	blood cancer	(b)	blood clots, arterio-sclerosis	(c)	bleeding, trauma, heart attack	(d)	high cholesterol, heart attack
52	Which of the following is NOT an example of continuous evolution?						
(a)	Antibiotic resistance	(b)	Body weight	(c)	Skin color	(d)	Insect wings
53	Which of following WBC is involved in preventing blood clotting						
(a)	neutrophils	(b)	eosinophils	(c)	monocytes	(d)	basophils
54	During day, O_2 is produced in the mesophyll cells as a:						
(a)	By product	(b)	Waste	(c)	Toxic product	(d)	End product
55	Carbon containing fossils fuels are?						
(a)	minerals and carbonate	(b)	peat, coal, petroleum	(c)	biodiesel	(d)	diamond
56	Seedless fruit plants are propagated by:						
(a)	grafting	(b)	cloning	(c)	cutting	(d)	binary fission
57	Diagphragm is a -------						
(a)	Thick bony structure present above the lungs	(b)	Thick covering around the lungs	(c)	A thin bony structure present above the lungs	(d)	A thick muscular structure present below the lungs
58	The cancer with highest death rate in the world is----------						
(a)	Lung cancer	(b)	Blood cancer	(c)	Skin cancer	(d)	Stomach cancer
59	Elastic cartilage is found in:						
(a)	trachea	(b)	Pinna, epiglottis	(c)	spine	(d)	Hip joint
60	Which of these is an antiviral protein?						
(a)	Urokinase	(b)	Thymosin	(c)	Interferon	(d)	Cecropin
61	The sensory layer of eye is:						
(a)	Retina	(b)	Iris	(c)	Cornea	(d)	Sclera
62	Night blindness can be avoided by taking----						
(a)	Lodosporin	(b)	Vitamin A	(c)	Vitamin B	(d)	Vitamin K
63	Nonsene codons?						
(a)	UAA, UAU, UUA	(b)	UGA, UAG, UAA	(c)	UGG, UGA, UAU	(d)	UGG,UAA,UAG

64	The lens found in human eye is:						
(a)	Concave	(b)	biconvex	(c)	Progressive	(d)	Trifocal lens
65	A vector is selected for the transfer of the isolated gene of interest to the:						
(a)	Host cell	(b)	DNA	(c)	Donor organism	(d)	None of these
66	The observable set of characteristics of an organism:						
(a)	Genotype	(b)	DNA	(c)	Phenotype	(d)	Genes
67	Pathogens contain proteins called:						
(a)	lipoproteins	(b)	histones	(c)	antibodies	(d)	antigens
68	Nitrogen fixation is conversion of nitrogen into:						
(a)	Nitric oxide	(b)	Nitric acid	(c)	Nitrate and ammonia	(d)	Nitrous oxides
69	Drugs used to relieve persistent or severe pain in chronic diseases e.g., cancer?						
(a)	Disprin	(b)	Narcotics	(c)	Sedatives	(d)	Panadol
70	The vector DNA and the inserted gene of interest are collectively called as:						
(a)	Transformed DNA	(b)	Transcript DNA	(c)	Recombinant DNA	(d)	Mutated DNA

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Part III: Biology-Descriptive Questions
[30 Marks]

Instructions:

- Attempt any FIVE questions. The questions carry 6 marks each.
- Only five questions will be marked so do not attempt extra questions.
- Answer the questions to-the-point. Do not write irrelevant details.
- Plz read solved examples for better understanding.

Solved example:

Question 0: You want to get high yield of potato. One fertilizers "Brand-A" in market claims to produce high potato yield than a generic "Brand-B" fertilizer. How will you test the claim of "Brand-A"?

Answer: Treat potato seeds the same way in two plots by sowing in similar soil, water and climate condition. One group will be applied with "Brand-A" fertilizer while other with "Brand-B". At the end of the growing season, harvest the potato and compare the yields of both groups by counting the total number of potatoes and weighing the total yield in each group.

Question 1: In the context of genetics, what is the reason of normal (healthy) and diseased siblings in same family if the parents are normal?

Question 2: Why is shivering likely during the onset of a fever?

Question 3: A drug for Leukemia is not broken down in the stomach and is well absorbed by the intestine. The traces/molecules of the drug found in the patient's blood do not match to the form that was swallowed by the patient. What is the possible explanation for this?

Question 4: The cell goes through a cycle that consists of four stages: G1, S, G2, and M. After DNA is duplicated in eukaryotes, it must be bound to histones. This required the synthesis of hundreds of millions of new protein molecules. When in the cell cycle stage (G1, S, G2, or M) histones are produced?

Question 5: If a child were born without a thymus gland, what cells and functions of the immune system would be deficient? Explain**.**

Question 6: How do biologists distinguish and categorize the millions of species on Earth? How humans and Chimps form a sister group?

-------End of paper-------