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-19, March 27, 2022

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. In multicellular organisms, similar cells are organized into groups, called
a) Organ b) Organ system c) Tissues d) Individual

2. The process by which one diploid cell divides to generate four haploid daughter cells is called
a) Mitosis b) Prophase c) Meiosis d) Anaphase

3. Red blood cells are also called erythrocytes and transport
a) nerve impulse b) Oxygen c) water d) food

4. A series of hypothesis supported by the results of many tests is called
a) Scientific law b) Theory c) Data d) Deduction

5. Artificial cleaning of blood is known as:
a) Dialysis b) Diabetes c) Lithotripsy d) Both a & b

OR

COMPUTER

1. All the instructions from the users and various softwares are carried out by the _____.
a) ALU b) MU c) CPU d) DVD

2. In a multi-button mouse, one button must be designated as the _____ button.
a) first b) left c) primary d) user

3. Memory that loses its data when power is turned off is considered _____ memory.
a) static b) volatile c) dynamic d) refreshed

4. The more _____ a processor has, the more powerful it is.
a) microns b) transistors c) connections d) neurons

5. This _____ cache holds the most recently used data or instructions.
a) L1 b) L2 c) L3 d) L4

CHEMISTRY

6. Which acid is present in vinegar?
a) Acetic Acid b) Formic Acid c) Oxalic Acid d) Hydro Chloric Acid

7. Which metal exist in fluid form at standard temperature and pressure conditions?
a) Mercury b) Bromine c) Sodium d) Calcium

8. Which one is not the contribution of Dalton in Chemistry?
a) Atomic theory b) Dalton Law c) Law of multiple proportion d) Law of conservation of mass

9 What is the empirical formula of Urea?
a) CH_4ON_2 b) $C_3H_4NO_3$ (c) CH_3NO_2 d) $C_6H_5NO_2$

10. Which vitamin is known as ascorbic acid?
a) Vitamin A b) Vitamin B c) Vitamin C d) Vitamin D

MATHEMATICS

11. If $a * b = a-b+ab$, then $2 * 5 + 5 * 2$ is
a) 14 b) 16 c) 20 d) none of these

12. Which of the fractions below is closest to 1?
a) 8/7 b) 9/10 c) 10/11 d) 11/10

13. $6^2 + |6| + |-6| - 6^2$ is equal to
a) -6 b) 0 c) 6 d) 12

14. $\frac{5^5}{5^4}$ is equal to
a) 1 b) 5 c) 25 d) 125

15. $(a^m)^n =$
a) $a^m n$ b) a^{m+n} c) a^{mn} d) None of these

PHYSICS

16. Which is a derived unit?
a) meter b) second c) kilogram d) newton

17. A boy weighing 500 newtons takes 50. seconds to climb a flight of stairs 18 meters high. His power output vertically is
a) 9,000 W b) 4,000 W c) 1,400 W d) 180 W

18. Which net charge could be found on an object?
a) $+3.2\times 10^{-18}$ C b) -1.8×10^{-18} C c) $+2.4\times 10^{-19}$ C d) -0.80×10^{-19} C

19. Compared to insulators, metals are better conductors of electricity because metals contain more free
a) protons b) electrons c) positive ions d) negative ions

20. Which two quantities are measured in the same units
a) momentum and work b) energy and power
c) mechanical energy and heat d) work and power

PART II – BIOLOGY

21. In which phase of Meiosis the homologous chromosomes separated from each other
    a) prophase 1 b) telophase 1 c) anaphase 1 d) Metaphase 1

22. An unbroken series of species arranged in ancestors to descendent sequence with each later species having evolved from one that immediately preceded it is called:
    a) Biome b) Phyletic lineage c) Community d) Population

23. Lipids are synthesized in
    a) Rough endoplasmic reticulum b) Chloroplast
    c) Ribosomes d) Smooth endoplasmic reticulum

24. Which of the following is an example of carnivorous plant
    a) Sundew b) Sunflower c) Sphagnum d) None of the above

25. Which of the macronutrient is involved in closing and opening of stomata
    a) potassium b) sulpher c) phosphorus d) calcium

26. It is possible to date the rocks by comparing the amount of specific radioactive isotopes they contain. Which of the statement is correct in this respect?
    a) Older sediment layers have an equal amount of these radioactive isotopes as that of the young ones
    b) Older sediment layers have less amount of these radioactive isotopes as that of the young ones.
    c) Older sediment layers have a greater amount of these radioactive isotopes as that of the young ones.
    d) Older sediment layers did not have these radioactive isotopes

27. The part of earth inhabited by organisms communities is known as
    a) Atmosphere b) Ecosystem c) Biosphere d) Environment

28. The scientific name of onion is
    a) Asterias rubens b) Brassica c) Allium cepa d) Allium sativum

29. The tissues covers the outside of body and lines organs and cavities are called
    a) Connective tissue b) Epithelial tissue
    c) Muscle tissue d) Simple tissue

30. Movement of molecules from an area of higher concentration to the area of lower concentration along the concentration gradient is called
    a) Facilitated diffusion b) Osmosis c) Diffusion d) Active transport

31. The meristem located on the tips roots and shoots is called
    a) Apical meristem b) Intercalary meristem
    c) Lateral meristem d) Cork cambium

32. Maximum number of species of living things on earth are
    a) Algae b) Fungi c) Insects d) Protozoa

33. The major component of fungi cell wall is
    a) Cellulose b) Peptidoglycan c) Cholesterol d) Chitin

34. The Ozone layer is contained within the
    a) troposphere b) mesosphere c) thermosphere d) stratosphere

35. Astronauts may use which technique to grow fruits and vegetables
    a) Tissue culture techniques b) Cloning
    c) Pasteurization d) Hydroponic culture technique

36. The process in which cell takes solid materials are called
    a) Endocytosis b) Exocytosis c) Phagocytosis d) Pinocytosis

37. Which blood vessel contain valves
    a) Arteries b) Veins c) Capillaries d) Arterioles

38. Pyruvic acid is converted to Acetyl CoA before entering in
    a) Calvin cycle b) ETC c) glycolysis d) Krebs Cycle

39. Scurvy result from the lack of vitamin
    a) Vitamin A b) Vitamin B c) Vitamin C d) Vitamin D

40. Biological sciences have a set methodology and it is based on
    a) Experimental inquiry b) Esthetic preference c) Philosophical ideas d) Imaginations

41. Which of the following is not an example of continuous evolution?
    a) Skin color b) Body weight c) Rose flower color d) None of the these

42. The process of loss of water from plant surface through evaporation is called
    a) Transpiration b) Transportation c) Respiration d) Transfusion

43. A molecule of DNA contains all of the following EXCEPT:
    a) Deoxyribose sugars b) Polypeptide bonds c) Phosphodiester bonds d) Nitrogenous bases

44. Which of the following is universal donor blood group
    a) A b) B c) AB d) O

45. Contraction of atria pushes the blood toward ventricles, this is called
    a) atria systole b) ventricles diastole c) atrial diastole d) ventricular systole

46. According to Mendel's law of independent assortment what will be the typical ratio of F2 in a dihybrid cross:
    a) 3:1 b) 5:1 c) 1:2:1 d) 9:3:3:1

47. Principle of 3R means
    a) Reduce, Renew, Recycle b) Reduce, Reuse, Recycle
    c) Reduce, Re-establish, Renew d) Reduce, Reforest, Recycle

48. *Spectrococcus* carries out a process called
    a) Alchohol fermentation b) Oxalate synthesis c) Malate synthesis d) Lactic acid fermentation

49. Which of the following enzymes dissolve blood clots
    a) Interferons b) Haemophillia c) Urokinase d) All of these

50. The primary structure of protein refers to the
    a) Sequence of sugar molecules in the protein
    b) Sequence of the DNA in the genome
    c) Sequence of peptide bonds in the protein molecule
    d) Sequence of amino acids in the polypeptide chain

51. Sleep movements are a type of
a) Turgor movements b) Growth movements c) Tactic movements d) Paratonic movements

52. The extreme change in pH results in:
a) Change in ionization of amino acids at the active site of the enzyme
b) Change in the ionization of the substrate
c) Denaturation of the enzyme
d) Increase in the reaction rate

53. Pathogen contains special proteins known as
a) Antigen b) Antibody c) Functional protein d) Resistant protein

54. Stomata present in leaves involves in the process of
a) Respiration b) Gaseous exchange c) Photosynthesis d) Both a & b

55. In the human body, 99% of total mass is formed of
a) 16 bioelements b) 12 bioelements c) 10 bioelements d) 6 bioelements

56. Thick muscular structure present below the lungs:
a) Ribs b) Intercoastal muscles c) Diaphragm d) None of these

57. The one which is a weed killer
a) IAA b) NAA c) 2 4-D d) GA

58. Amount of Carbon dioxide in inspired air:
a) 20% b) 0.56% c) 4% d) 0.04%

59. Primary chemical stimulus for breathing is the concentration of:
a) Carbon dioxide in blood b) Carbon dioxide in muscles c) Oxygen in blood d) Oxygen in muscles

60. Maintenance of internal body conditions at equilibrium, despite changes in the external environment:
a) Homeostasis b) Osmoregulation c) Excretion d) None of these

61. U-shape structure present in Nephron known as:
a) Renal tubule b) Loop of Henle c) Collecting duct d) Medulla

62. Glomerulus is:
a) Cup shape structure b) Functional unit of kidney c) Network of capillaries d) None of these

63. Which of the following occurs in anaerobic respiration but not in aerobic respiration?
a) Release of CO2 b) Reduction of NAD
c) Formation of ATP d) Production of ethanol from acetaldehyde

64. Chemical coordination is brought about by:
a) Nervous system b) Endocrine system c) Both a & b d) None of these

65. Fusion of the bones at joint may occur and joints may become totally immoveable in:
a) Gout b) Arthritis c) Osteoporosis d) Osteocytes

66 Calyx is a collection of
a) Petals only b) Sepals and petals c) Corolla d) Sepals only

67. *Hydra* and corals also reproduce by means of:
a) Sexual reproduction b) Budding c) Asexual reproduction d) Both a & b

68. Scar present on a seed coat known as:
a) Radicle b) Plumule c) Hilum d) Epicotyl

69. The one which is not a globular protein
a) Anti Rh-antibody b) Enzyme c) Myosin d) Hemoglobin

70. The basic structural unit of a chromosome is
a) The centromere b) Nucleosome c) Telomere d) Histone

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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 1: 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: What advantages did plants gain from the evolution of secondary growth?

Question 4: Why doesn't gastric juice destroy the stomach cells that make it?

Question 5: A zoo animal eating ample food shows signs of malnutrition, how will you (as a researcher) determine which nutrient is lacking in its diet?

Question 6: A person traveling from Pakistan to America suffers from sleep disorder. What is the reason?

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