राष्ट्रीय विज्ञान संग्रहालय परिषद
**National Council of Science Museums**
ब्लॉक-जी एन, सेक्टर-V, बिधान नगर
Block – GN, Sector – V, Bidhan Nagar
कोलकाता/Kolkata-700091

## Aptitude Test for Selection of Education Assistant 'A'

| **Date: 17.02.2024** | **Duration: 3.00 Hrs.** | **Max. Marks: 100** |
|---|---|---|

Name of the Candidate: _____ Exam Centre_____ Form No._____

Signature of the Candidate _____ Invigilator's Signature: _____

### General Instructions:

1. All the questions from Question No.1 to 60 are compulsory.
2. Answer all the Multiple Choice Questions (1 to 60) in the "OMR" Sheet.
3. There will be no negative marks for wrong answers (from Q. Nos.1 to 60).
4. In the Section-'B', answer either Group-I or Group-II only.
5. Calculators, Bluetooth devices, Mobile phones, Smartwatches etc. are not allowed in the Examination Hall.
6. Rough work may be done on question paper or blank sheet to be provided in the Examination Hall.

### Instruction for Filling the "OMR" Sheet:

1. Use **pen** for filling the OMR sheet.
2. Darken the bubbles completely. Half-filled or over-filled bubbles will not be evaluated.
3. Writing on the OMR Sheet is permitted on the specified area only.
4. Writing/marking on other than specified area is not permitted.
5. Do not fold the OMR Sheet.
6. Do not make any stray marks on the OMR sheet.
7. Multiple markings are invalid.
8. Put your signature in the appropriate place, in front of the Invigilator if required.

## Section-'A' (60 Marks)

1. What will be the value of acceleration due to gravity on the surface of the earth if the radius of the earth suddenly decreases to 60% of its present value, keeping the mass of the earth unchanged?

   a. 9.81 $m/s^2$
   b. 24.89 $m/s^2$
   c. 216.35 $m/s^2$
   d. 27.25 $m/s^2$

2. The unit of Planck's constant (h) is equivalent to:

   a. Joule/meter
   b. Joule second
   c. Newton second
   d. Watt second

3. If a particle moves in a circle with constant speed, then its:

   a. Velocity is constant
   b. Acceleration is constant
   c. Acceleration is zero
   d. The direction of motion changes continuously

4. Light of a certain frequency shines on a metal surface resulting in the emission of two electrons: P and Q. Electron P is more loosely bound than electron Q. Compare the kinetic energies of the two electrons after emission.

   a. $KE_P = KE_Q$
   b. $KE_P > KE_Q$
   c. $KE_P < KE_Q$
   d. These can not be related

5. Power is defined as :

   a. Doing work only
   b. Change of momentum
   c. Rate of doing work
   d. Transfer of energy

6. The terminal velocity of a sphere falling through a viscous fluid depends on:

   a. The radius of the sphere only
   b. The viscosity of the fluid only
   c. Both the radius of the sphere and the viscosity of the fluid
   d. Neither the radius of the sphere nor the viscosity of the fluid

7. In a standing wave pattern, a point where the amplitude is always zero is called :

   a. Antinode
   b. Node
   c. Crest
   d. Trough

8. In an atom, an electron transitions from the ground state to a certain energy level. Which of these are true for this process?

   a. The energy of the atom increases
   b. The energy of the atom decreases
   c. A photon is released
   d. None of the above

9. In Gauss's law, the electric flux through a closed surface depends on:

   a. The size of the surface
   b. The shape of the surface
   c. The total charge inside the surface
   d. The electric field outside the surface

10. Two bulbs rated 40W-220V and 100W-220V are connected in series to a 220V supply. Which bulb will glow brighter?

    a. 40W bulb
    b. 100W bulb
    c. Both will glow equally bright
    d. None will glow

11. Which of the following is the correct IUPAC name?

    a. 3-ethyl-4, 4-dimethylheptane
    b. 4, 4-dimethyl-3-ethylheptane
    c. 5-ethyl-4, 4-dimethylheptane
    d. 4, 4-Bis(methyl)-3-ethylheptane

12. Which molecule has a zero dipole moment?

    a. $NH_3$
    b. $H_2O$
    c. $CO_2$
    d. $SO_2$

13. The heat of hydrogenation of cyclohexene is:

    a. A measure of its stability
    b. Higher than that of benzene
    c. Lower than that of cyclohexane
    d. The same as that of cyclohexane

14. The primary causes of acid rain are:

    a. $CO_2$ and methane
    b. $SO_2$ and $NO_x$
    c. Ozone and peroxyacetyl nitrate
    d. Hydrocarbons

15. Which type of radiation is the least penetrating?

    a. Alpha
    b. Beta
    c. Gamma
    d. X-ray

16. The major element that is found in all organic molecules and is capable of forming long chains and rings is .....?

    a. Nitrogen
    b. Hydrogen
    c. Oxygen
    d. Carbon

17. In a chemical equilibrium, the rate of the forward reaction is:

    a. Greater than the rate of the reverse reaction.
    b. Less than the rate of the reverse reaction
    c. Equal to the rate of the reverse reaction
    d. Unpredictable without experimental data

18. In gas chromatography, what is the primary purpose of the stationary phase?

    a. To move the sample through the column
    b. To separate components based on their boiling points
    c. To absorb the components of the mixture
    d. To separate components based on their interactions with the stationary phase

19. Enzymes increase the rate of a chemical reaction by:

    a. Increasing the temperature
    b. Decreasing the activation energy
    c. Increasing the concentration of reactants
    d. Acting as a reactant

20. Which of the following correctly lists the substances $CH_3COOH$, $SO_2$ and $Cl_2$ in order of increasing intermolecular forces?

    a. $CH_3COOH < Cl_2 < SO_2$
    b. $Cl_2 < SO_2 < CH_3COOH$
    c. $Cl_2 < CH_3COOH < SO_2$
    d. $SO_2 < Cl_2 < CH_3COOH$

21. The perimeter of a rectangle is 60 m. What can be its maximum area?

    a. cannot be determined
    b. 3600 sq.m
    c. 900 sq.m
    d. 225 sq. m

22. The learning rate for new skills is proportional to the difference between the maximum potential for learning that skill, M, and the amount of the skill already learned, L. Which equation describes this relationship?

    a. $L(t) = \frac{k}{(M-L)}$
    b. $\frac{dL}{dT} = \frac{k}{(M-L)}$
    c. $L(t) = k(M - L)$
    d. $\frac{dL}{dT} = k(M - L)$

23. Find two numbers such that the sum of the numbers is 12 and the sum of their squares is 74:

    a. 4 and 8
    b. 8 and 4
    c. 7 and 5
    d. 6 and 6

24. When 1 is subtracted from the numerator, a fraction becomes 1/3, and when 8 is added to the denominator, it becomes 1/4. The fraction is:

    a. 3/12
    b. 4/12
    c. 5/12
    d. 7/12

25. If two coins are tossed simultaneously, the probability of getting at least one head is:

    a. ¼
    b. ½
    c. ¾
    d. 1

26. In a colony, there are 55 members. Every member posts a greeting card to all the members. How many greeting cards were posted by them?

    a. 908
    b. 902
    c. 2970
    d. 1980

27. Seema is to randomly select one animal from her lab for a study. There are 5 salamanders, 3 crayfish, and 12 minnows in the lab. What is the probability that she will select a salamander?

    a. 0. 6
    b. 0.15
    c. 0.25
    d. 0.20

28. Calculate the area under the curve $f(x) = 7 - x^2$, from $x = -1$ to 2

    a. 14/3 sq units
    b. 18 sq units
    c. 3 sq units
    d. None of the above

29. A spherical balloon is being inflated so that its volume is increasing at the rate of $10cm^3/sec$. Find the rate at which the diameter is increasing when the diameter is 20cm?

    a. $1/(20\pi)$ cm/s
    b. $1/(40\pi)$ cm/s
    c. 1/20 cm/s
    d. 1/40 cm/s

30. The length of a chord of a circle is 16 cm. Its perpendicular distance from the centre of the circle is 6cm. What is the diameter of the circle?

a. 5.29 cm
b. 10.58 cm
c. 10 cm
a. 20 cm

31. The number of orbitals in the fourth shell is:

a. 16
b. 32
c. 64
d. 8

32. At what temperature are Celsius and Fahrenheit equal?

a. 100°
b. -40°
c. 100°
d. 0°

33. What are the crystallization's initial materials?

a. Liquid, aqueous solution, emulsion
b. Gas, aqueous solution, foam
c. Aqueous solution, melt, glass or gel
d. Solid, gas, melt, solid aerosol

34. What Sulfur exists in two polymorphic forms _____ and _____?

a. Rhombic and monoclinic
b. rhombic and triclinic
c. hexagonal and triclinic
d. hexagonal and monoclinic

35. In a nucleophilic substitution reaction, the presence of a withdrawing group:

a. Increases the reactivity of haloalkanes
b. Decreases the reactivity of haloalkanes
c. Does not affect the reactivity of haloalkanes
d. Stabilises the transition state

36. What chemical, known for its calorie-free sweetness and ability to withstand high temperatures, is often used as a sweetening agent

a. Sucrose
b. Glucose
c. Aspartame
d. Sucralose

37. The carbohydrate that is used in the silver mirror test is:

a. Glucose
b. Fructose
c. Sucrose
d. Starch

38. If a protein is excessively heated, its shape changes and the protein will no longer carry out its function. This process is called?

a. Hydrolysis
b. Thermal catabolism
c. Denaturation
d. Ionization

39. The rate of a chemical reaction doubles for every 10°C rise in temperature. If the reaction rate is 1 at 20°C, what would be the rate at 50°C?

a. 2
b. 4
c. 8
d. 16

40. Which of the following is not a characteristic of chordates?

a. Notochord
b. Dorsal hollow nerve cord
c. Diploblastic
d. Pharyngeal gill slits

41. Insects respire through:

a. Lungs
b. Gills
c. Tracheae
d. Skin

42. The water vascular system is a characteristic feature of:

a. Mollusca
b. Echinodermata
c. Arthropoda
d. Annelida

43. The connective tissue that connects muscle to bone is known as:

a. Ligament
b. Cartilage
c. Tendon
d. Adipose tissue

44. A direct link between genes and enzymatic reactions known as the famous " one gene, one enzyme" hypothesis, was put forth by:

a. George Wells Beadle and Edward Lawrie Tatum
b. James D. Watson and Francis Crick
c. Maurice Wilkins and Rosalind Franklin
d. Marie Curie and Pierre Curie

45. What is the primary function of the large intestine in the human digestive system?

a. Nutrient absorption
b. Protein digestion
c. Water absorption
d. Carbohydrate digestion

46. Which of the following characteristics of pea plants was not used by Mendel in his experiments?

a. seed colour
b. seed shape
c. pod length
d. flower position

47. Which of the following is an example of genetic engineering?

a. Identifying the sequence of bases in plant DNA
b. Growing a whole plant from a single cell
c. Attaching a root of one type of plant to the stem of another type of plant
d. Inserting a gene into plants that make them grow faster

48. Enzyme responsible for breaking down starch into maltose in the mouth is:

a. Lipase
b. Amylase
c. Trypsin
d. Pepsin

49. What plant is considered to be a "Living Fossil"?

a. Juniper
b. Ginkgo biloba
c. Mushroom
d. Algae

50. Which of the following is a characteristic feature of reptiles?

a. Cold-blooded
b. Three-chambered heart
c. Live birth
d. Lays eggs in water

51. The Lymph differs from blood in having:

a. More RBC and less WBC
b. Less RBC and more WBC
c. No RBC and less WBC
d. No RBC and more WBC

52. Which among the following is incorrect about seeds based on the presence of the endosperm?

a. Endosperm is usually absorbed and digested by the developing embryo
b. Seeds that lack endosperm at maturity are called non-endospermic seeds
c. Seeds that contain endosperm are called endospermic seeds
d. In endospermic seeds, the embryo gets absorbed and digested even before the seed gets

53. A new fungus was discovered to produce a secretion that immediately stops bacteria from replicating. Which of the following does the secretion most likely inhibit?

a. Replication fork formation
b. RNA polymerase
c. Translation
d. Transcription

54. Which of these is a major concern about the overuse of antibiotics:

a. It can lead to antibiotic resistant bacteria
b. antibiotics can cause secondary infections
c. antibiotics will get into the water systems
d. There can be antibiotic shortage

55. Which structure provides a surface for the settlement of pollen grains in angiosperm plants

a. Anther
b. Style
c. Stigma
d. Pollen Tube

56. Tadpoles have to change a lot before they turn into frogs. These changes include:

a. Growing lungs, teeth and legs
b. Growing gills, teeth and legs
c. Growing lungs, teeth and a tail
d. Growing gills, teeth and a tail

57. Cephalopods are important molluscs that include:

a. Snails, slugs and limpets
b. Ammonites, squids and nautiloids
c. Cockles, molluscs and clams
d. None of the above

58. Platypus has a poor eyesight. To find its prey it uses special receptors in its bill. These receptors pick up:

a. Radio waves
b. Ultra-violet lights
c. Electrical impulses
d. Infra-Red impulse

59. Syngamy can occur outside the body of the organisms in.....?

a. Algae
b. Ferns
c. Fungi
d. Mosses

60. A scientist notices that adding the pesticide DDT to a culture of bacteria encourages the production of enzymes that degrade the DDT. The following term best describes the type of genetic control observed by the scientist:

a. Repression
b. Induction
c. Positive control
d. Negative control

## Section-'B' (40 marks)

(**Answer either Group-I or Group-II only**)

**GROUP-I:**

**PHYSICAL SCIENCE**

Write short note on *any 2* (two) of the given topics (max words 400)

Marks: 2 x 20 = 40

1. Are 'Electric Vehicles' really worth the hype?
2. The role of Artificial Intelligence in shaping the future of work and society
3. Renewable energy sources in mitigating climate change
4. Potential benefits and risks of space exploration and colonization
5. Origin of the universe

**OR**

**GROUP-II:**

**BIOLOGICAL SCIENCE**

Write short note on *any 2* (two) of the given topics (max words 400)

Marks – 2 x 20 = 40

1. CRISPR: A revolution in the field of evolution
2. Antimicrobial resistance- a global threat
3. The ethical considerations of animal testing in scientific research
4. Climate change and human behaviour
5. Water Crisis in India, the world's largest groundwater user

*******