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Construction and Validation of an Achievement Test for Concept Assessment in Biology

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Abstract

The study was carried out to construct and validate an achievement test based on selected topics of Biology taken from CBSE class IX Science curriculum. The test, consisting of 50 objectives based multiple choice test items, was developed by the investigator to measure students' knowledge, understanding, application and analysis about selected biological concepts. The preliminary draft of achievement test comprised of 80 items which were edited on the basis of the suggestions made by Biology teachers/experts and class X students: some items were dropped and some were modified to obtain the second draft of the test with 65 items. After eliminating 15 items, as a consequence of item analysis and validation by experts, 50 items were retained in the final version of test. Test-retest reliability was calculated by administering the achievement test on a sample of 70 students and the value of coefficient of correlation was found to be 0.928, thus establishing the high reliability of the test constructed. Validity of the achievement test was established by content validity method.

Keywords: Multiple Choice Achievement test, Concept Assessment, Item Analysis, Validity, Reliability

Introduction

Achievement test is a significant tool in evaluating students' learning of a specific subject area and also to determine instructional progress. Multiple choice tests are very suitable measurement tools for determining the level of knowledge of different subjects of many students at different academic levels (Burton, Sudweeks, Merrill and Wood, 1991). Concept assessments are sets of multiple-choice questions, often based on common student misconceptions that are designed to test understanding without relying on memorisation. Well-designed, valid and reliable assessment tools that allow instructors to capture student learning of the main concepts of biology are becoming an essential way to inform biology instructors about what students learn in biology courses (Knight, 2010). Test reliability refers to the degree to which a test is consistent and stable in measuring what it is intended to measure. A reliable test minimizes error and provides repeatable consistent results. Validity refers to the degree to which the test actually measures what it claims to measure. It is essential for a test to be valid in order for the results to be accurately applied and interpreted. Content validity as defined by Anatsi and Urbina (1997) is a non-statistical type of validity that involves "the systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measure. As the investigator did not get an appropriate and validated tool with established psychometric properties suitable for assessing learners' achievement in acquisition of biological concepts in selected topics of Biology of class IX, the same was developed and validated by her.



Objective of the Study

To construct and validate an achievement test for class IX students for concept assess in Biology

Methodology Adopted

The following steps were taken by the investigator during construction and standardization of the achievement test in Biology:

- Planning the test
- Preparation of the test
- Try out or Item Analysis
- Establishing Reliability And Validity

Construction and Validation of the Achievement Test

Planning the Test

The following aspects were taken into consideration while planning the test: students for whom the test was intended, what was to be measured and the timings of the measurement. The test was meant for class IX students (age group 14 – 15 years) studying in of CBSE affiliated schools. Acquisition of Biological concepts was to be measured and the objectives (cognitive domain) to be realized were: knowledge, understanding, application and analysis. Measurement of the achievement was taken after exposing students to teaching learning transaction of the selected topics for acquisition of biological concepts.

- **Writing Objectives**

Investigator followed Gronlund's approach for writing general and specific objectives for the selected 12 topics of biology (Table 1).

Table 1: General and Specific Objectives

Sr. No.	Topics	General Objectives	Specific Objectives	Item No.
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1	Cell - Discovery & Theory	<ul style="list-style-type: none"> ➤ Know the definition of cell. ➤ Know how cells were discovered. ➤ Apply the acquired knowledge to identify cell components. ➤ Deduce that cell is the basic unit of life ➤ Understand the concept of the cell theory. 	<ul style="list-style-type: none"> • Define cell. • Name the scientist who discovered cells. • Identify cell components from stained temporary mount of onion peel when seen under a microscope. • Identify cell components from stained temporary mount of cheek cells when seen under a microscope. • Enlist major points of the cell theory. 	1 2 4 5 3
2	Cell – Diversity & Types	<ul style="list-style-type: none"> ➤ Understand about diversity of cells. ➤ Know about the types of cells. ➤ Apply the acquired knowledge to identify different types of cells. 	<ul style="list-style-type: none"> • Define unicellular organisms. • Name a unicellular organism that keeps on changing its shape. • Define an organelle. • Identify the type of a cell on the basis of its microscopic structure. 	6 7 14 16
3	Movement of substances across Cell Membrane	<ul style="list-style-type: none"> ➤ Know the structure of cell membrane. ➤ Apply the acquired knowledge to identifying structure of cell membrane from the diagram. ➤ Understand the process of diffusion across cell membrane. ➤ Draw inferences from the illustrations showing movement of substances across cell membrane. 	<ul style="list-style-type: none"> • Identify the chemical substances that form the framework of plasma membrane. • Mention the role of plasma membrane that it plays due to its property of selective permeability. • Name the process by which oxygen molecules (O₂) move from the lungs into the bloodstream. • Describe the movement of water through a semi permeable membrane stretched across a chamber filled with 	15 8 11 10 12



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		<ul style="list-style-type: none"> ➤ Understand the process of osmosis, exocytosis and endocytosis. 	<p>water on its one side and salt solution on the other.</p> <ul style="list-style-type: none"> • Define hypotonic, isotonic and hypertonic solutions. • Mention the function of exocytosis in cells. • Name the process referred to as 'cell eating'. 	13 9
4	Cell Structure – Cytoplasm & Nucleus	<ul style="list-style-type: none"> ➤ Know the structure of cytoplasm and nucleus. ➤ Understand the functions of cytoplasm and nucleus. 	<ul style="list-style-type: none"> • Mention the combined name given to the nucleus and cytoplasm of a cell. • Match various parts of nucleus to their structure and functions. 	24 19
5	Cell Structure – Ribosomes, Endoplasmic Reticulum & Golgi Apparatus	<ul style="list-style-type: none"> ➤ Know the functions of ribosomes, endoplasmic reticulum and Golgi apparatus. ➤ Draw conclusion from given situation related to ribosomes. 	<ul style="list-style-type: none"> • Name the cell organelle that carries out the process of packaging and exporting proteins. • Name the organelle that forms the supporting skeletal framework of the cell. • Describe what will happen if all the ribosomes of a cell are destroyed. 	23 25 20
6	Cell Structure – Lysosomes & Mitochondria	<ul style="list-style-type: none"> ➤ Know the structure of lysosomes & mitochondria. ➤ Apply the acquired knowledge to identify mitochondrion from the diagram ➤ Understand the functions of mitochondria. 	<ul style="list-style-type: none"> • Name the organelles that are popularly called suicidal bags. • Identify mitochondrion from its structure given in the diagram. • Explain why mitochondria are called 'Powerhouses' of the cell. 	21 18 26
7	Plant vs. Animal Cells	<ul style="list-style-type: none"> ➤ Recall that in plants food is prepared by chloroplasts that contain chlorophyll. ➤ Apply the knowledge and understanding of cell structure to differentiate 	<ul style="list-style-type: none"> • Name pigment containing organelles that collect light energy to produce food. • List major differences between animal Cell and plant Cell. 	17 22



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		between plant and animal cells.		
8	Plant Tissues- Meristematic & Simple Permanent	<ul style="list-style-type: none"> ➤ Know the characteristic features of meristematic & simple permanent tissues found in plants. ➤ Understand how the structures of various types of simple permanent tissues correlate to their functions. ➤ Analyze the given features to identify the tissue of which coconut husk is made of. 	<ul style="list-style-type: none"> • Define meristematic tissue. • Name the tissue that provides flexibility to plants. • Identify the feature that enables Aerenchyma to give buoyancy to the aquatic plants. • The husk of coconut is made of a tissue composed of long and narrow dead cells with thick lignified walls. Identify the tissue. 	27 28 33 34
9	Plant Tissues – Complex Permanent	<ul style="list-style-type: none"> ➤ Know various types of simple permanent tissues ➤ Know the characteristic features of complex permanent tissues found in plants. ➤ Understand how the functions performed by different elements of xylem correlate to their corresponding structures. 	<ul style="list-style-type: none"> • Name the tissue that conducts food from leaves to different parts of a plant • Name the elements of phloem with which companion cells are associated. • Identify the functions performed by different elements of xylem. 	29 35 30



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10	Plant Tissue Systems	<ul style="list-style-type: none"> ➤ Understand how different tissue systems in plants carry out different functions. ➤ Understand the structural modifications of epidermis in relation to specialized roles. 	<ul style="list-style-type: none"> • Identify the tissue systems on the basis of their characteristics features. • Mention another name for bark. • Identify the substance that makes cork impermeable. • Why do desert plants have thick waxy coating of cutin outside the epidermis? • Name the two kidney shaped cells that enclose stomata. 	38 31 32 36 37
11.	Animal Tissues – Epithelial & Muscular	<ul style="list-style-type: none"> ➤ Know the structure of various types of epithelial and muscular tissues. ➤ Understand how the structures of various types of epithelial tissues correlate to their unique functions. ➤ Deduce that the skeletal muscles are responsible for body movements. ➤ Draw conclusion that the most abundant organelles in muscle cells are mitochondria. 	<ul style="list-style-type: none"> • Identify the characteristic feature that best describes epithelium. • Name the epithelial tissue that forms the lining of kidney tubule • Mention the major role that stratified epithelium plays in our body. • Identify the muscular tissue that is involved in the movements of the arm. • How is structure of cardiac muscles related to their action? • Identify the organelles which are expected to be most abundant in human skeletal muscle cells. 	49 43 41 39 47 50
12.	Animal Tissues – Connective & Nervous	<ul style="list-style-type: none"> ➤ Know the structure of various types of connective and nervous tissues. ➤ Understand how the structures of various types of connective and nervous tissues correlate to their unique functions. 	<ul style="list-style-type: none"> • Name the component of the blood that forms its liquid part. • Identify parts of the bone on the basis of their structure. • Name the fat storing tissue found in animals. • Differentiate between tendons and ligaments. • Identify various parts of a nerve cell. 	40 44 46 45



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		<ul style="list-style-type: none"> ➤ Differentiate between tendons and ligaments. ➤ Identify various parts of a nerve cell. ➤ Compare the connective tissue with epithelial tissue. 	<ul style="list-style-type: none"> • Identify the feature that differentiates Connective tissues from epithelial tissues. 	42
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- **Preparing a table of specification**

Having identified the objectives to be achieved, a table of specification was prepared in order to relate the expected outcomes to the content and also to indicate the relative weightage assigned to objectives to be achieved of each selected topic (Table 2).



Table 2: Table of Specifications

Topics	Objectives	Remember	Understand	Apply	Analyze	Total Items
Cell – Discovery and Theory		2	1	2		5
Cell – Diversity & Types		2	1	-	1	4
Movements across Cell Membrane		1	2	1	3	7
Cell Structure – Cytoplasm & Nucleus		1	1	-		2
Cell Structure –Ribosomes, Endoplasmic Reticulum & Golgi Apparatus		2	-	-	1	3
Cell Structure – Lysosomes & Mitochondria		1	1	1	-	3
Plant vs. Animal Cells		-	1	-	1	2
Plant Tissues- Meristematic & Simple Permanent		2	1	-	1	4
Plant Tissues – Complex Permanent		2	1	-	-	3
Plant Tissue Systems		3	2	-	-	5
Animal Tissues – Epithelial & Muscular		1	3	1	1	6
Animal Tissues – Connective & Nervous		3	1	1	1	6
TOTAL		20	15	6	9	50

(Figures in the cells indicate the number of items to be given to each topic and each objective to be achieved).



Preparation of the Test

The achievement test consisting of all multiple choice items related to the selected topics of Biology was devised by the investigator keeping in mind the objectives and the content of items. It was ensured that no objective remained untested. Preparation of preliminary draft of the test was carried out in two stages: Item-Writing and Item-Editing

➤ Item Writing

The investigator prepared the preliminary draft of Achievement test comprising of 80 multiple choice test items keeping in mind the rules for writing such items proposed by Haladyna and Downing (1989). The following points were considered while writing multiple choice test items:

- Each item was constructed to assess a single written objective.
- Language used was simple to express items precisely, clearly and simply.
- Vocabulary used was appropriate for the level of the test. Using unnecessarily difficult vocabulary was avoided.
- Each item was tested for basic grammar, punctuation, and spelling. To avoid giving clues to the right answer, parallel grammar was used for all the option choices.
- Each item was laid out in a clear and consistent manner
- Instructions were clear and simple.
- To avoid testing rote facts, text language was avoided.
- The question or problem situation was presented in the stem of the item, not the options.
- Interdependence among items was avoided.
- Such items that provide a clue to the answer of other items were avoided.
- Use of specific determiners like always, never, seldom, sometimes etc. were avoided.
- Use of the alternatives “all of the above” and “none of the above” were avoided as use of the same has been found in several studies to decrease item discrimination and test score.
- The four option choices addressed the same content, and the distracters were reasonable choices for a student with limited or incorrect information
- Options were arranged in systematic manner and names in alphabetic order.
- The number of test items framed initially was larger than the number of items retained finally.

➤ Item Editing

After scrutinizing the items closely by the investigator, the test was given to 10 Biology teachers/experts to

- critically analyze the items for the content and language,
- correct ambiguities,
- check that all the defined objectives are tested ,
- add any other area of relevance
- and suggest any other relevant test item.



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Scoring key was also made and got scrutinized. The test was also given at individual level to 25 students of class X studying in different schools of Chandigarh to seek their suggestions. On the basis of the suggestions made by the Biology teachers/experts and class X students, the preliminary test was reframed to prepare the second draft by dropping 15 items and modifying a few. Thus the second draft of the test comprised of 65 multiple choice items.

Try out/ Item Analysis

The second draft was administered on 100 class IX students studying in two schools of Chandigarh: Government Model Senior Secondary School, Sector 18 and Shri Guru Harkrishan Model School, Sector 38. Students had to choose one answer from each multiple choice test item that comprised of four choices. The answer scripts of the students were evaluated with the scoring key. One mark was given for each correct response and each wrong answer was given zero. The scores thus obtained were arranged in descending order and subjected to Kelley's item analysis technique (1939) to find the difficulty value (DV) and discriminating power (DP). Item analysis is the process to evaluate the effectiveness of items in a test by exploring the examinees' responses to each item. The following formulae were used to calculate the difficulty value (DV) and discriminating power (DP):

$$DV = (RU+RL) / n$$

$$DP = (RU-RL) / (n/2)$$

Where

RU – Number of correct response in the upper group.

RL - Number of correct response in the lower group.

n – Size of sample in upper and lower groups.

The upper and lower groups were made as follows

- All the answer scripts of the students were arranged in descending order on the basis of total marks obtained.
- The first 27% cases formed the upper group and the last 27% cases formed the lower group.

The difficulty value (DV) and discriminating power (DP) for each item of the achievement test are shown in Table 3

Table 3: Difficulty Value (DV) and Discriminating Power (DP) of Achievement Test

Item No.	Upper Group (RU)	Lower Group (RL)	DV/DP	Accepted/Rejected
1.	12	7	0.73/0.38	Accepted
2.	8	3	0.42/0.38	Accepted



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3.	13	7	0.76/0.46	Accepted
4.	9	6	0.57/0.23	Accepted
5.	10	5	0.57/0.38	Accepted
6.	7	4	0.42/0.23	Accepted
7.	10	7	0.65/0.23	Accepted
8.	8	5	0.5/0.23	Accepted
9.	12	10	0.85/0.15	Rejected
10.	10	4	0.54/0.46	Accepted
11.	10	9	0.73/0.076	Rejected
12.	8	5	0.54/0.23	Accepted
13.	12	7	0.73/0.38	Accepted
14.	10	7	0.65/0.23	Accepted
15.	11	8	0.73/0.23	Accepted
16.	7	6	0.5/0.076	Rejected
17.	11	7	0.69/0.3	Accepted
18.	12	10	0.84/0.15	Rejected
19.	5	8	0.5/-0.23	Rejected
20.	12	8	0.77/0.31	Accepted
21.	8	4	0.46/0.31	Accepted
22.	9	6	0.57/0.23	Accepted
23.	13	6	0.73/0.23	Accepted



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24.	10	4	0.54/0.46	Accepted
25.	12	7	0.73/0.38	Accepted
26.	10	2	0.46/0.62	Accepted
27.	8	7	0.57/0.076	Rejected
28.	13	8	0.81/0.38	Accepted
29.	12	6	0.69/0.46	Accepted
30.	7	7	0.54/0	Rejected
31.	13	11	0.92/0.15	Rejected
32.	6	4	0.38/0.15	Rejected
33.	9	4	0.5/0.38	Accepted
34.	12	9	0.81/0.23	Accepted
35.	8	3	0.42/0.38	Accepted
36.	11	9	0.77/0.15	Rejected
37.	7	10	0.65/-0.23	Rejected
38.	10	9	0.73/0.76	Rejected
39.	13	8	0.81/0.38	Accepted
40.	12	3	0.57/0.69	Accepted
41.	6	2	0.31/0.31	Accepted
42.	12	11	0.81/0.076	Rejected
43.	10	7	0.65/0.23	Accepted
44.	8	6	0.53/0.15	Rejected



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45.	7	3	0.38/0.31	Accepted
46.	11	3	0.53/0.23	Accepted
47.	9	4	0.5/0.38	Accepted
48.	11	2	0.5/0.69	Accepted
49.	10	6	0.62/0.31	Accepted
50.	12	8	0.77/0.31	Accepted
51.	8	3	0.42/0.38	Accepted
52.	13	3	0.62/0.77	Accepted
53.	7	6	0.5/0.076	Rejected
54.	12	5	0.65/0.54	Accepted
55.	10	5	0.58/0.38	Accepted
56.	12	8	0.77/0.31	Accepted
57.	9	4	0.5/0.38	Accepted
58.	12	7	0.73/0.38	Accepted
59.	10	3	0.5/0.54	Accepted
60.	8	3	0.42/0.38	Accepted
61.	7	4	0.42/0.23	Accepted
62.	12	6	0.69/0.46	Accepted
63.	9	2	0.42/0.54	Accepted
64.	19	4	0.5/0.38	Accepted
65.	11	5	0.62/0.46	Accepted



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The items having difficulty value (DV) ranging from 0.25 to 0.75 and the items ranging from 0.20 to 0.90 on the discriminating power (DP) were retained. The items at Sr. No. 9,11,16,18,19,27,30,31,32,36,37,38,42,44 and 53 were rejected and items at Sr. No. 3,20,28,34,39,50 and 56 were modified and retained. Thus a total of 50 items were retained for the final draft of the achievement test with the specification shown in Table 4.

Table 4: Table of Specifications (Final Draft)

Sr. No.	Topics	Item Numbers as per objectives				Total Items
		Remember	Understand	Apply	Analyze	
1.	Cell – Discovery& Theory	1,2	3,	4,5	-	5
2.	Cell – Diversity & Types	7,14	6	-	16	4
3.	Movements across Cell Membrane	9	8,13	15	10,11,12	7
4..	Cell Structure – Cytoplasm & Nucleus	24	19	-	-	2
5.	Cell Structure –Ribosomes, Endoplasmic Reticulum & Golgi Apparatus	23,25	-	-	20	3
6.	Cell Structure – Lysosomes & Mitochondria	21	26	18	-	3
7.	Plant vs. Animal Cells	-	17	-	22	2
8.	Plant Tissues- Meristematic & Simple Permanent	27,28	33	-	34	4
9.	Plant Tissues – Complex Permanent	29, 35	30	-	-	3
10	Plant Tissue Systems	31,32,37	36,38	-	-	5
11.	Animal Tissues – Epithelial & Muscular	43	41, 47,49	39	50	6



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12.	Animal Tissues – Connective & Nervous	40, 44,46,	42	48	45	6
TOTAL		20	15	6	9	50

Reliability of the Test

To find the reliability of the Achievement Test, test-retest method was used. The test was administered, on a sample of 70 students of class X studying in the selected schools of Chandigarh, twice at an interval of three weeks and then correlated to ensure reliability of the scores. The coefficient of reliability was found to be 0.93 indicating the test to be highly reliable.

Validation of the Test

Validity of the achievement test was established by content validity method. Content validity is a logical process where connections between the test items and the objectives of a particular domain are established. Items are chosen so that they comply with the test specification which is drawn up through a thorough examination of the subject domain.

To determine the content validity of the Achievement Test, 10 Biology teachers/experts were given this test individually to review the test items and comment on whether each item appropriately matched to the content area specified and the intended outcomes. As the table of specifications and the items were found to match adequately (Tables: 1,2,4), the content validity of the achievement test was ascertained.

Final Draft

Having carried out the entire process of construction and validation of the achievement test, selected items were arranged to prepare the final version of the Achievement test (appended as Annexure 1).

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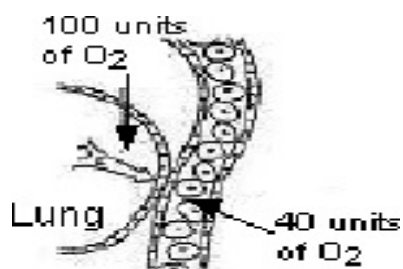
*Annexure 1***ACHIEVEMENT TEST (BIOLOGY)****Instructions:**

1. Tick the correct answer.
 2. Time allowed is 30 minutes.
1. **Structural and functional unit of life is**
 - a. Protoplasm
 - b. Tissue
 - c. Cell
 - d. Organ
 2. **After observing a thin slice of cork under a self designed microscope, the term 'cell' was coined by**
 - a. Robert Brown
 - b. Purkinje.
 - c. Leeuwenhoek
 - d. Robert Hooke
 3. **Cell theory described 'cell' as the basic unit of life, because**
 - a. All cells come from pre -existing cells.
 - b. All plants and animals are composed of cells.
 - c. All organisms are composed of many cells.
 - d. Cells are created spontaneously.
 4. **If you observe a stained temporary mount of onion peel under the compound microscope, which of the following organelles will you see**
 - a. Nucleus
 - b. Mitochondria
 - c. Golgi Body
 - d. Lysosomes
 5. **Human cheek cell was stained, mounted and observed under the compound microscope. Which of the following components of cell would be seen**
 - a. Cell wall, nucleus and cytoplasm.
 - b. Plasma membrane, cytoplasm, nucleus.
 - c. Plasma membrane, nucleus, mitochondria
 - d. Cell wall, nucleus, vacuole.
 6. **A unicellular organism is one which**
 - a. Can live only inside other organism.
 - b. Can survive only in the presence of oxygen.
 - c. Consists of only one cell.



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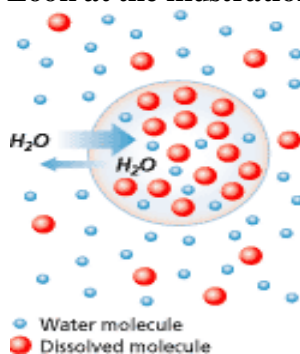
- d. Consumes other organisms.
7. **A unicellular organism that keeps on changing its shape is**
- Amoeba
 - Chlamydomonas
 - Euglena
 - Paramecium
8. **Due to its property of selective permeability, plasma membrane acts as a**
- Ceiling
 - Floor
 - Gateway
 - Wall
9. **'Cell eating' refers to**
- Endocytosis
 - Exocytosis
 - Osmosis
 - Pinocytosis
10. **A semi permeable membrane is stretched across a chamber filled with water. 60 mg of salt is added to the left side of the chamber. Which of the following will happen?**
- Salt will move toward the left side.
 - Salt will move toward the right side.
 - Water will move toward the left side.
 - Water will move toward the right side.
11. **Oxygen molecules (O_2) move from the lungs into the bloodstream. Movement across the cell membrane as shown in this diagram is called**



- Active transport
- Diffusion
- Facilitated diffusion
- Osmosis

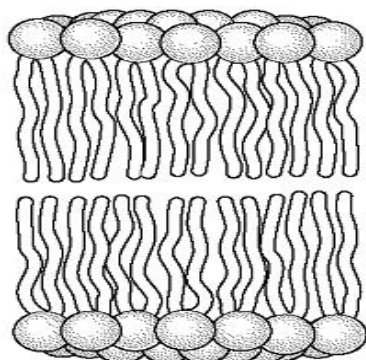


12. Look at the illustration (given below) of an animal cell surrounded by a solution.

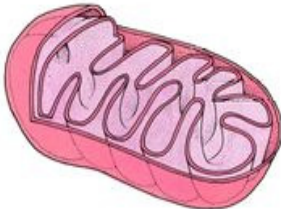


This solution is

- a. Hypertonic
 - b. Hypotonic
 - c. Isotonic
 - d. Osmotic
13. A cell uses 'exocytosis' to
- a. Incorporate nutrients.
 - b. Move away from danger.
 - c. Pump protons.
 - d. Release substances from the cell.
14. An organelle
- a. Exists only in animal cells
 - b. Exists only in plant cell
 - c. Has a specific function to perform
 - d. Transports waste material out of cell.
15. Referring to the diagram given below, framework of the plasma membrane is made of



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- a. Actin and Myosin
 - b. Cellulose and Pectin
 - c. Phospholipid Bilayer
 - d. Water and Carbon dioxide
16. **If you observed a cell under a microscope and noticed that it contained a plasma membrane, cell wall, and ribosomes, but none of the other organelles, you identify it as**
- a. Animal cell
 - b. Damaged cell
 - c. Eukaryotic cell
 - d. Prokaryotic cell.
17. **The pigment containing organelles in autotrophs that collect light energy are**
- a. Chloroplasts
 - b. Lysosomes
 - c. Mitochondria
 - d. Ribosomes
18. **Identify the organelle pictured below.**
- 
- a. Chloroplasts
 - b. Endoplasmic Reticulum
 - c. Golgi Apparatus
 - d. Mitochondrion
19. **Which of the following pairs is MISMATCHED?**
- a. Chromosomes : Hereditary material
 - b. Nuclear Membrane : Non-porous
 - c. Nucleolus : Ribosomal RNA
 - d. Nucleus : DNA replication
20. **If all the ribosomes of a cell are destroyed, then**
- a. Fats will not be used.
 - b. Photosynthesis will not occur.
 - c. Proteins will not be formed.
 - d. Respiration will not occur.



21. **Organelles popularly called ‘suicidal bags’ are**
- Centrosomes
 - Lysosomes
 - Peroxisomes
 - Chromosomes
22. **Which of the following statements correctly describes a difference between plant cells and animal cells?**
- Animal cells contain chloroplasts. Plant cells do not.
 - Animal cells contain mitochondria. Plant cells do not.
 - Plant cells are surrounded by a cell wall. Animal cells are not.
 - Plant cells have an envelope surrounding the nucleus. Animal cells do not.
23. **The process of packaging and exporting proteins is carried out by**
- Endoplasmic Reticulum
 - Golgi Apparatus
 - Mitochondrion
 - Nucleolus
24. **Combined name given to the nucleus and cytoplasm of a cell, is**
- Cytoplasm
 - Nucleoplasm
 - Protoplasm
 - Vacuole
25. **The cell organelle forming the supporting skeletal framework of the cell is**
- Endoplasmic reticulum
 - Golgi apparatus
 - Mitochondrion
 - Ribosome
26. **Mitochondria are often called ‘powerhouses’ of the cell because they**
- Convert food into energy
 - Convert light into food
 - Posses hydrolytic enzymes
 - Store food.
27. **Meristematic tissue consists of cells that**
- Are mature
 - Divide continuously to form new cells.
 - Elongate and cause growth.
 - Store food.
28. **Tissue providing flexibility to plants is**
- Chlorenchyma
 - Collenchyma



- c. Parenchyma
d. Sclerenchyma
29. **Water is transported to different parts of a plant by**
a. Collenchyma
b. Phloem
c. Sclerenchyma
d. Xylem
30. **Which of the following components of xylem is INCORRECTLY matched with its characteristics?**
a. Trachieds- Conducting tissue
b. Vessels- Non-conducting tissue
c. Xylem fibers- Supportive tissue
d. Xylem parenchyma-Storage tissue
31. **Another name for bark is**
a. Endodermis
b. Epidermis
c. Periderm
d. Phloem
32. **Cork is impermeable due to the presence of**
a. Cutin
b. Lignin
c. Silica
d. Suberin
33. **Tissue which gives buoyancy to the aquatic plants to help them float in water is**
a. Aerenchyma
b. Chlorenchyma
c. Collenchyma
d. Sclerenchyma
34. **You must have observed that the husk of coconut is fibrous, it is made of**
a. Aerenchyma
b. Collenchyma
c. Parenchyma
d. Sclerenchyma
35. **Companion cells are associated with**
a. Cambium
b. Collenchyma
c. Sieve tubes
d. Xylem
36. **In desert plants epidermis has a thick waxy coating of cutin to**
a. protect the plant from animal grazing
b. reduce evaporation of water
c. increase the surface area
d. help in photosynthesis

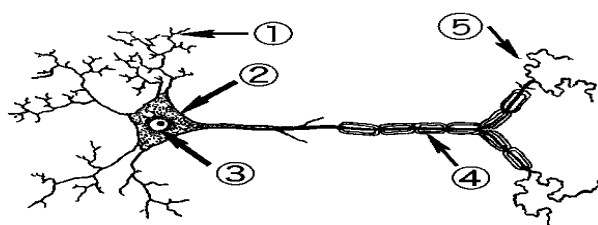


- 37. Stomata are enclosed by two kidney shaped cells called**
- Companion cells
 - Epidermal cells
 - Guard cells
 - Subsidiary cells
- 38. Tissue system which synthesizes organic compounds, supports the plant, and provides storage for the plant is**
- Cork
 - Dermal
 - Ground
 - Vascular
- 39. When you move your arm to use your computer mouse, the muscular tissue involved is**
- Cardiac
 - Involuntary
 - Skeletal
 - Smooth
- 40. The liquid part of the blood is known as**
- Cytoplasm
 - Heamoglobin
 - Plasma
 - Stroma
- 41. Stratified epithelium is found in areas of the body where the principal activity is**
- Absorption
 - Diffusion
 - Filtration
 - Protection
- 42. Tissue responsible for transmitting impulses is**
- Connective
 - Epithelial
 - Muscular
 - Nervous
- 43. Epithelial tissue that forms the lining of kidney tubule is**
- Cuboidal
 - Columnar
 - Simple
 - Stratified



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44. **The longitudinal channels of bone are called**
- Haversian canals
 - Lacunae
 - Marrow cavity
 - Volkman's canal
45. **Ligaments differ from tendons as**
- Ligaments connect bones to muscles whereas tendons connect two bones.
 - Ligaments connect muscles to each other whereas tendons connect muscles to epithelium.
 - Ligaments connect muscles to epithelium whereas tendons connect muscles to each other.
 - Ligaments connect two bones whereas tendons connect bones to muscles.
46. **Fat storing tissue is**
- Aerolar
 - Adipose
 - Epithelial
 - Muscular
47. **Due to their characteristic action of causing rhythmic contraction and relaxation of heart , cardiac muscles are**
- Striated
 - Involuntary
 - Unbranched
 - Voluntary
48. **Referring to the diagram of the neuron given below, choose the correct sequence of the labelling of its parts (1,2,3,4,5)**



- Nerve ending, Axon, Nucleus, Dendrite, Cell body
 - Axon, Nerve ending, Nucleus, Dendrite, Cell body
 - Cell Body, Nerve ending, Axon, Nucleus, Dendrite
 - Dendrite, Cell Body, Nucleus, Axon, Nerve ending
49. **Which of the following statements best describes epithelium?**
- It contains large amounts of matrix.
 - Its free surface is exposed to the exterior of the body or to the interior of a hollow structure.
 - It is always arranged in a single layer of cells.
 - It has an abundant blood supply.



- 50. The organelles expected to be most abundant in human skeletal muscle cells are**
- a. Endoplasmic Reticulum
 - b. Golgi Complex
 - c. Lysosomes
 - d. Mitochondria

