

**ASSESSMENT OF UTILIZATION AND IMPACT OF BIOLOGY LABORATORY
FACILITIES ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL
STUDENTS IN GOMBE STATE, NIGERIA**

Auwal Abubakar^{1*}, Magaji Shehu²

1.Federal College of Education Technical Potiskum Yobe State Nigeria

2.Department of Educational Foundations, Federal University DutsinMa, P.M.B. 5001, Dutsin-
Ma, Nigeria.

auwalabubakargombe19@gmail.com

Received: 14/ 01/ 2021; Reviewed: 17/ 02/ 2021, Accepted: 24/ 02/ 2021

Abstract

The study focused on the assessment of utilization and impact of biology laboratory facilities on students' academic achievement in senior secondary schools in Gombe State, Nigeria. One null hypothesis was formulated. Ex-post facto research design was adopted. The population from which the sample was collected is eight hundred and seventy-three (873) final year biology students. A sample of one hundred and sixty-two (162) biology students was selected using random sampling technique. Questionnaire for students was Utilization of Biology Laboratory Facilities (UBLF) and Bio achievement Test was also used as instrument for data collection. The instruments were validated by a professor in the Department of Education in Bayero University Kano, and secondary school Biology teachers. Cronbach Alpha Coefficient was used to determine its reliability in which the coefficient of 0.79 was obtained. To answer the research question, percentages were used. And to test the hypothesis, T-test statistical technique was employed. The hypothesis was subjected to testing at 0.05 level of significance. It was revealed that there is a significant impact between utilization of laboratory equipment and senior secondary school students' academic achievement in biology in Gombe State. Based on these findings, it was recommended among others that, supervisors and inspectors from the Ministry of Education, State Universal Basic Education Boards (SUBEB) and Zonal Education offices should strictly monitor, inspect and ensure a hitch free utilization of the available science laboratory facilities in teaching and learning of Biology in the state.

Keywords: utilization, impact, Biology Laboratory Facilities, Academic Achievement.

Introduction

Utilization of laboratory facilities defines the extent or the frequency of using the available science laboratory equipment, reagents, charts, and models during classes or laboratory sessions. The use of laboratory facilities in teaching offers student the opportunity to develop scientific skills such as observation, objectivity, creativity, communication and critical thinking among others. Laboratory equipments promote learning by doing, make the classroom lively, real and meaningful and have the potential to make the content permanent thereby influencing students' academic achievement. The distinction between laboratory or field learning and traditional classroom learning is that activities are student-centered, with students actively engaged in hands-on, minds-on activities using laboratory or field materials and techniques. Biology laboratory activities are interested in having students acquire knowledge and in having them work with concrete objects;

In biology theory and practical demonstration of knowledge are closely linked in that deficiency in one aspect adversely affects competence in the other. The examinations organized by both West African Examination Council (WAEC) and National Examination Council (NECO) demand that the candidates should respond to questions on both theoretical and practical knowledge alike. The results of such examinations have shown that the candidates probably lack the competence expected of them since the rate of failure in the two organized exams is relatively high (Sadiq, 2007).

Against this background, the researcher believes that the availability and utilization of biology laboratory facilities may have an influence on students' academic achievement, especially at the senior secondary school levels. This study proposes the use of biology laboratory facilities for effective teaching and learning. Biology as a science subject cannot be taught outside laboratory and in the absence of laboratory facilities. The academic achievement of students in biology in SSCE over the past few years in the study area has not been impressive. This is shown in the 2013, 2014, 2015, and 2016 WAEC May/June results for some of the secondary schools in Gombe State.

Table 1 indicates percentage distribution of some selected secondary school students' performance in May/June West African Senior Secondary School Certificate Examination (WASSCE) in Biology in Gombe State, Nigeria 2013 - 2016.

Table1. Secondary School Students' Percentage Results In Biology in Gombe State

YEAR	NO. OF CANDIDATES REGISTERED	NO. CANDIDATES WITH CREDITS PASSES 1-6	OF PERCENTAGES OF CANDIDATES WITH CREDITS PASSES 1-6
2013	1, 230	66	5.37%
2014	1, 165	78	6.69%
2015	1, 100	102	9.27%
2016	1, 079	310	28.7%

Teachers were blamed for not using the available laboratory facilities during teaching-learning process. Students were equally blamed for destroying laboratory facilities like the conical flask and beakers, charts like human skeletal charts, and other related facilities use in the laboratory.

Biology Laboratory Facilities

Biology laboratory facilities are the materials used in the laboratory for teaching and learning process. These facilities are reagents like agar, benedict solution, iodine solution, ammonium solution, methyl orange, sodium chloride. These were mostly used for preservation of specimens. Then we have charts for illustration like a charts of human anatomy, kidney chart, life cycle of mosquito, eye chart, skeleton & muscular system. Additionally, we have equipments like microscope, disposable gloves, dissecting sets for dissection, test tube rack, test tube holder, wash bottles, specimen container, tripod stand, sieves, and thermometer. These equipments help in making the experiments easier.

Moreover, we have anatomy models including: kidneys, human brain, human ear, human heart, human head, skeleton of human being, skeleton of rabbit. These are used in the laboratory in which students can touch and identify vital organs in the models and their functions.

Laboratory equipments have various functions which are as follows;

- a) Supply a concrete basis for conceptual thinking and reduce meaningless word responses of students.
- b) Make learning more permanent.
- c) Have a high degree of interest for the learner.
- d) Offer a reality of experience which stimulates self-activity on the part of students.
- e) Develop a continuity of thought.
- f) Provide experiences not easily obtained through other materials and contribute to the efficiency, depth and variety of learning.

Academic achievement

Academic achievement refers to a successful accomplishment or performance in a particular subject area. It is indicated by grades, marks and scores of descriptive commentaries (Augustine, 2013). Academic achievement also refers to how students deal with their studies and how they cope with or accomplish different tasks given to them by their teachers in fixed time or academic year. Academic achievements of students in science subjects generally have witnessed a deplorable trend in the past decades. Studies have shown that science laboratories in Nigeria are poorly equipped. As Muhammad (2017) reported that in most senior secondary schools in Sokoto state Nigeria, there are no laboratories, where they exist, they are poorly equipped. Teachers indicated reluctance and inability in conducting practical lessons using the few available laboratory facilities.

Despite the expected benefits of utilizing laboratory facilities in the teaching/learning process. There has been consistent failure in students' performance in biology of the West African Senior School Certificate Examinations in biology in Nigeria (Umeh, 2006). The failure has been attributed to underutilization of biology laboratory facilities in some senior secondary schools in Nigeria. School facilities have been observed as a potent factor to quantitative education. Ihejiamaizu and Ochui (2016) find out that utilization of biology laboratory equipment significantly influenced student's academic performance in biology. Ihejiamaizu et. al. (2016) also

concluded that when students are exposed to the use of biology laboratory equipment, they tend to perform better than they would have done without these facilities. The proper place for the study of science is the laboratory. Biology being one of the science subjects cannot be taught and learnt effectively in absence of properly equipped laboratory facilities.

Bruner (1997) introduced the concept of learning by discovery. Bruner is of the view that learning is effectively engaging if the learner is given the opportunity to discover facts by him/herself. This goes hand in hand with this study by leading the students to laboratory to observe some specimen/ facilities and identify them by their physical features, functions of parts of the body of the organism being observed. Bruner (1997) argues that mere presentation of information will not enhance effective solution of a problem. In biology, when teaching skeletal system, the teacher needs to take the students to laboratory in order to show them a model of a human skeleton for them to see, touch, and be actively engaged in their own learning.

From a constructivist perspective, teachers serve in the role of guides, monitors, coaches, tutors and facilitators. In the constructivist classroom, students work primarily in groups in which learning and knowledge are interactive and dynamic. It is also encouraged in the constructivist's classroom that students individually perform an experiment and then come together as a class to discuss the results. Exploration is a favored approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals. Hence, constructivist theories include the notion that learning is active, social, and situated in particular physical, social, and cognitive contexts that involve the ongoing development of complex and interrelated mental structures.

Learning is an active process in which the learner uses sensory input and constructs meaning out of it. Dewey (1972) stressing that learner needs to do something; that learning is not the passive acceptance of knowledge which exists out there, but that learning involves the learners engaging with the world. The crucial action of constructing meaning is mental, it happens in the mind, physical actions hands-on experience may be necessary for learning especially for children. Therefore, we need to provide activities which engage the mind as well as hands (Dewey called this reflective activity). Dewey (1972) recognizes the application of knowledge as an integral aspect of learning. One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structures developed from previous knowledge to build on the more we know,

the more we can learn. Therefore, any effort to teach must be connected to the state of the learner by providing a path into the subject for the learner based on the learner's prior knowledge.

Rabi Muhammad (2017) examined the availability, its utilization and maintenance of biology laboratory equipment and facilities in secondary schools in Sokoto state. A sample of 30 senior secondary schools and 30 biology teachers were selected from the population of secondary schools in the state using stratified sampling technique. The study employed the use of observation checklist as an instrument for data collection. The above study did not consider the effect of availability, utilization and maintenance of biology laboratory facilities on students' academic achievement. Findings indicated that most senior secondary schools in Sokoto state had no laboratories, and in some cases, they are poorly equipped. Poor maintenance culture was also discovered among biology teachers in Sokoto state. It was recommended among others that science laboratories should be well-equipped with relevant modern facilities for effective teaching.

Objective of the Study

The main objective of the study is to assess the utilization and impact of biology laboratory facilities on academic achievement of senior secondary schools students in Gombe state Nigeria.

Research Questions

The study sought to find answers the following questions:

1. What is the level of utilization of biology laboratory facilities in science secondary schools in Gombe state?
2. What is the relationship between the utilization of biology laboratory facilities and secondary school student's academic achievement in biology in Gombe state?

Null Hypothesis

The following null hypothesis is formulated for the study.

- a) There is no significant impact of biology laboratory facilities on secondary school student's academic achievement in biology in Gombe State.

Methodology

Research Design

This study is set to investigate the assessment of availability, utilization and of biology laboratory facilities and their impact on student's academic achievement in Gombe state Nigeria. An ex-post facto research design was used for the study. An ex-post facto is a data collection technique that attempt to determine the cause effects of variables and it cannot be manipulated.

Sample Size

The sample for the study is one hundred and sixty two (162) students. This figure agrees with the research advisers (2006) table for determining sample size from a given population.

Sampling Technique

A random sampling technique was used in selecting the schools, students and teachers for the study. Two local government areas are to be selected from each of the three educational zones using random sampling. In each of the selected local government areas, one (1) secondary school is selected using the same random sampling. In each of the selected schools, an arm of SS 3 class was selected at random. Data obtained from the samples indicated that there is an average of 27 students per class.

Data Collection Instrument(s)

The following instruments were used for data collection

- i. Questionnaires for students
- ii. Biology Achievement Test

The questionnaire used is;

- a. Utilization of Biology laboratory facilities (UBLF).

The Utilization of Biology laboratory facilities (UBLF) with the same fifty (50) items, respondents to indicate the level of facility utilization as to whether never used before, occasionally utilized, or it is use always.

Bio achievement test (BAT)

Bio Achievement Test (BAT) was 15 item multiple choices adopted from past WAEC questions; had four (4) options with one correct answer and three distracters to measure the achievement of students based on the utilization of biology laboratory facilities. Each question carried one mark, fifteen marks was the overall mark.

Procedure for Data Collection

The researcher travelled to the selected schools for the study with the instruments for the collection of data; the first visits were on the first week of first term. The second visit were on the sixth week of the first term, which are validated copies of the questionnaires. The Utilization of Biology laboratory facility (Students questionnaire) (UBLF) was served to the respondents (students) with the help of teachers. Data with respect to students' academic achievements in biology was obtained through the administration of the Bio Achievement Test to the selected students by the researcher with the assistance of the biology teachers.

Procedure for Data Analysis

The data was analyzed using descriptive statistics, which include mean and standard deviation, frequency distribution, percentages to answer research questions while the hypothesis was tested using parametric statistics for data analysis corresponding with the hypothesis. The frequency distribution table and t- test were used for data analysis of different categories. The hypothesis was tested at 0.05 level of significance. T-test was used to test hypothesis to determine significant relationship between the utilization of Biology laboratory facilities and secondary school students' academic achievement. The data analysis employed the Statistical Package for Social Sciences (SPSS).

Data Presentation and Analysis

1. What is the level of utilization of biology laboratory facilities in secondary schools in Gombe state?

Table 2 Level of Equipment Utilization (Cited in Students' Questionnaire)

	EQUIPMENT	Never Utilized	Occasionally Utilized	Always Utilized
1.	Aquarium pump	43.5(%)	56.5(%)	0.00(%)
2.	Aquaria tank	27.8(%)	72.2(%)	0.00(%)
3.	Barometer	62.8(%)	27.6(%)	3.7(%)
4.	Chemical balance	50.0(%)	40.0(%)	10.0(%)
5.	Conical flask	30.8(%)	52.6(%)	17.6(%)
6.	Crucibles	20.0(%)	60.2(%)	19.8(%)
7.	Petri dish	29.5(%)	63.5(%)	7.0(%)
8.	Photometer	29.0(%)	51.0(%)	20.0(%)
9.	Pipettes/droppers	24.0(%)	59.0(%)	17.0(%)
10.	Dissecting box	40.7(%)	52.8(%)	7.7(%)
11.	Entomological pins	42.0(%)	56.0(%)	2.0(%)
12.	Funnel (glass or plastic)	50.0(%)	42.0(%)	8.0(%)
13.	Glass rods	38.0(%)	60.0(%)	2.0(%)
14.	Gas cylinder	26.5(%)	65.8(%)	7.7(%)
15.	Beaker	16.0(%)	67.0(%)	17.0(%)
16.	Pipette	27.8(%)	67.0(%)	84.4(%)
17.	Hydrometer	45.0(%)	52(%)	3.0(%)
18.	Microscope	21.0(%)	55.0(%)	24.0(%)
19.	Measuring cylinder	12.0(%)	78.0(%)	10.0(%)
20.	Specimen container	21.5(%)	68.0(%)	11.5(%)

21.	Thermometer	30.2(%)	52.6(%)	17.2(%)
22.	Test tube	20.0(%)	68.5(%)	11.5(%)
23.	Watch glass	13.0(%)	57.0(%)	30.0(%)
24.	Tripod stand	30.0(%)	57.0(%)	13.0(%)
25.	Bunsen burner	38.0(%)	52.0(%)	10.0(%)
26.	Wire gauge	34.0(%)	53.7(%)	13.3(%)
27.	Rain gauge	29.0(%)	60.9(%)	10.1(%)
28.	Test tube holder	10.5(%)	73.5(%)	16.0(%)
29.	Preserved specimen	39.5(%)	43.5(%)	17.0(%)
30.	Reagent bottles	28.0(%)	58.0(%)	16.0(%)
	Average percentages	32.3(%)	57.4(%)	14.4(%)

The average percentages in Table 2 indicate that 32.3% of the equipment are never utilized, 57.4% of the equipment are used but occasionally. The average percentages shows equipment is use always with 14.4%. We can conclude that in some of the secondary schools in Gombe State, equipment is never used before.

Table 3 Level of Reagents Utilization (Cited in Students' Questionnaire)

	REAGENTS	Never Utilized	Occasionally Utilized	Always Utilized
31.	Acetic acid	27.5(%)	56.5(%)	16.0(%)
32.	Ammonium solution	30.2(%)	60.5(%)	9.3(%)
33.	Sodium chloride	26.7(%)	55.8(%)	18.5(%)
34.	Sulphuric acid	24.8(%)	64.0(%)	11.2(%)

35.	Methylene powder	31.0(%)	69.0(%)	0.00(%)
36.	Methyl orange	11.0(%)	79.0(%)	10.0(%)
37.	Maltose	40.0(%)	60.0(%)	0.00(%)
	Average percentages	27.3(%)	63.5(%)	10.5(%)

The average percentages in Table 3 show that 27.3% of the reagents are never utilized, 63.5% of the reagents are used but occasionally, the average percentages show reagents are use always with 10.5%. We can conclude that in some of the secondary schools in Gombe State, reagents are never used before.

Table 4 Level of Charts Utilization (Cited in Students' Questionnaire)

	CHARTS	Never Utilized	Occasionally Utilized	Always Utilized
38.	Human anatomy	11.7(%)	64.0(%)	24.3(%)
39.	A flowering plant	27.8(%)	63.8(%)	9.4(%)
40.	Kidney chart	24.9(%)	58.1(%)	17.0(%)
41.	Eye chart	24.0(%)	66.0(%)	10.0(%)
42.	Skeleton & muscular system	24.0(%)	56.0(%)	20.0(%)
43.	Life cycle of mosquito	37.8(%)	53.0(%)	9.2(%)
	Average percentages	25.0(%)	60.1(%)	15.0(%)

The average percentages in Table 4 shows that 25.0% of the charts are never utilized, 60.1% of the charts are used but occasionally. The average percentages shows charts are always used with

15.0%. We can conclude that in some of the secondary schools in Gombe State, charts are never used before.

Table 5 Level of Models' Utilization (Cited in Students' Questionnaire)

MODELS		Never Utilized	Occasionally Utilized	Always Utilized
44.	Human kidney	16.5(%)	73.0(%)	10.5(%)
45.	Human brain	12.2(%)	77.0(%)	10.8(%)
46.	Human ear	24.0(%)	55.5(%)	20.5(%)
47.	Human heart	26.5(%)	53.5(%)	20.0(%)
48.	Skeleton of rabbit	18.1(%)	71.9(%)	10.0(%)
49.	Human head	29.0(%)	63.3(%)	7.7(%)
50.	Skeleton of human being	20.0(%)	80.0(%)	0.00(%)
Average percentages		20.9(%)	67.7(%)	11.4(%)

The average percentages in table 4 demonstrate that 20.9% of the models are never utilized. 67.7% of the models are used but occasionally. The average percentages show that models are always used with 11.4%. We can conclude that in some of the secondary schools in Gombe State, models are used but not all the time.

Table 5: The correlation between the use of laboratory facilities and students' achievement

Hypothesis: There is no significant impact of biology laboratory facilities on secondary school students' academic achievement in biology.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Score	162	3.8642	1.57427	.12369

One-Sample Test

Test Value = 0						
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Score	31.242	161	.000	3.86420	3.6199	4.1085

Interpretation

H₁: There is a significant impact of biology laboratory facilities on secondary school students' academic achievement in biology.

From the above t- test, we reject the null hypothesis since the p- value (0.00) is less than the critical value at 0.05% level of significance and conclude that there is a significant relationship between the utilization of laboratory facilities and students' academic achievement in biology.

Discussions of Findings

In the schools with biology equipment, teachers do not make proper use of the facilities and use them only for examination purposes. However, these equipments can be appropriately used for teaching and learning process to succeed in Biology. Therefore; the use of laboratory facilities is inevitable. Proper usage of such facilities will enhance better results in Biology examination and lay a solid foundation for future studies in science. This finding is in agreement with Neji, Amba, Nouha & Chinwendu. O (2015) whom observed that laboratory facilities are not adequately utilized in secondary schools for teaching chemistry, for teaching and learning process to succeed in Biology, the use of laboratory facilities is inevitable. Proper usage of such facilities will enhance better results in Biology examination and also lay a solid foundation for future studies in science.

The reasons for the non-utilization of biology laboratory facilities are as a result of:

- Biology laboratory facilities are lacking or insufficient

- b) Lack of practical knowledge by the biology teachers.
- c) There was no time allocation for the laboratory activities in the school time table.

Recommendations

The discussions on the findings reflect the impact of biology laboratory facilities on senior secondary school students' academic achievement. Based on the findings, it was concluded that the study provides empirical evidence of the influence of biology laboratory facilities on senior secondary school students' academic achievement. This implies that senior secondary school students who were taught using biology laboratory facilities perform better than students who were taught without biology laboratory facilities.

On the basis of the findings emanating from this study, the following recommendations are made for consideration by educational administrators, curriculum planners, and measurement and evaluation bodies:

1. Policies and guidelines should be formulated for the efficient use of science laboratories for teaching and learning purpose.
2. Ministries of Education and schools should provide separate laboratories for the science subjects, and encourage their usage by students and ensure effective use of laboratories at all levels of education.
3. Ministries of Education should organize workshop and seminars for biology teachers to improve their skills in the use of biology laboratory facilities.

Conclusion

The researcher concluded that most of the secondary schools in Gombe state lack adequate biology laboratory equipment for every student in biology class. As such, it was concluded that most of the schools in Gombe State only use some of these equipment for examination purposes. Some of the facilities are used only by the teachers. It was also concluded that students in schools with available facilities performed better than the students in schools without the biology laboratory facilities. Laboratory facilities are inadequate; teachers do not expose students to field trips. Few materials available could enhance effective teaching and learning of Biology. All items of science laboratory

equipment, apparatus, material and chemicals are inadequately provided and inefficiently used in the schools. Lack of availability and the under-utilization of science laboratory facilities have a negative impact on academic achievement of the students. However, if all the items of the Biology laboratory facilities are provided, proper allocation and efficiently used, it may have a large impact on the academic achievement of the students.

References

- Augustine, M.C. (2013). Effect of students improve instructional materials on senior secondary school students' achievement in Biology. Unpublished M.Ed. thesis UNN
- Brunner, J.S. (1997). Towards a theory of instruction, Cambridge: Belkrop press.
- Dewey, A. G. (1972). Educational or indoctrination, Journal of Moral Education 2(1):5-15
- Federal Ministry of Education (2008). Development of instructional materials from local resources: Basic education teachers Handbook. *Nigerian Educational Research and Development Council (NERDC). Presented at the Workshop on improvisation of science equipment.*
- Gombe state ministry of education (2014)
- Ihejiamaizu C. C. and Ochui, I. O. (2016). British Journal of Education Vol.4, No.9, pp.63-71, August 2016.
- Neji, Hope Amba, Nuoha, Chinwendu.O (2015) Utilization of Laboratory Facilities and Students' Academic Performance of Chemistry Students in Calabar, Nigeria. *Chemistry and Materials Research* ISSN 2224- 3224 ISSN 2225- 0956 Vol.7 No.3,57
- Rabi Muhammad, (2017) A survey of availability, utilization and maintenance of biology laboratory equipment and facilities in secondary schools in Sokoto State, Nigeria. *International Journal of Science and Technology*, 6(112),
- Sadiq, B. (2007). *Fundamentals of vocational and technical education*, Kano, Smith standard.

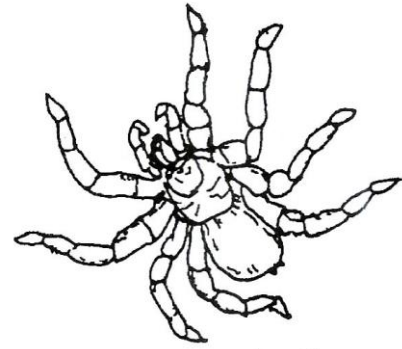
Umeh, I. E. (2006). Students socio-psychological factor as determinants of achievement in senior secondary Mathematics. Retrieved November 22, 2019 from <http://www.emeraldinsight.com>

BIO-ACHIEVEMENT TEST

Respondents are asked to find the correct answers from the provided options for each question below:

1. Which of the following of animals do not possess s nervous system?
 - A. Porifera
 - B. Cnidaria
 - C. Platyhelminthes
 - D. Nematoda
2. The structural similarities in Paramecium and Euglena are in the
 - A. Shape of locomotory organs.
 - B. Blunt anterior and mega nuclei in both
 - C. Presence of anterior and posterior contractile
 - D. Presence of anterior and posterior contractile vacuoles.
3. Which of the following organisms cannot exist freely on its own?
 - A. Chlamydomonas
 - B. Amoeba
 - C. Paramecium
 - D. Plasmodium

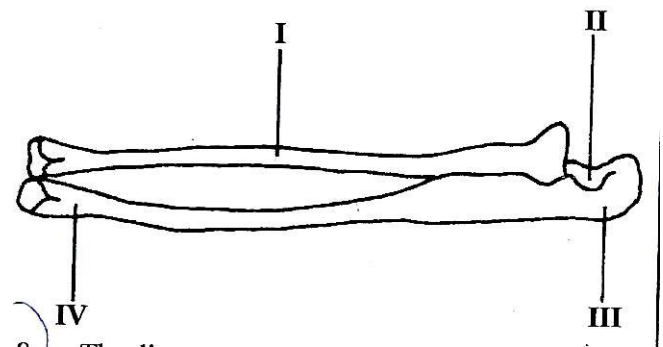
The diagram below is an illustration of an Arthropod. Study it and answer question



4. The arthropod in the diagram is not an insect because it.
- A. Has a big head which is almost equal to the thorax.
 - B. Has eight legs and no wings
 - C. Does not have visible eyes on its head
 - D. Has head, thorax and abdomen
5. An example of osmosis in plants is the?
- A. Movement of water through the xylem
 - B. Loss of water vapour from the stomata
 - C. Translocation of food through the stomata
 - D. Absorption of water from the soil by the root

The diagram below illustrates a part of the human skeleton. Study it and answer questions 6 to 8.

6. The diagram represents the bones of the?
- A. Upper arm
 - B. Lower arm
 - C. Upper leg
 - D. Lower leg.
7. Which of the labeled parts articulates with the head of the trochlea to form a hinge joint?
- A. I
 - B. II
 - C. III
 - D. IV

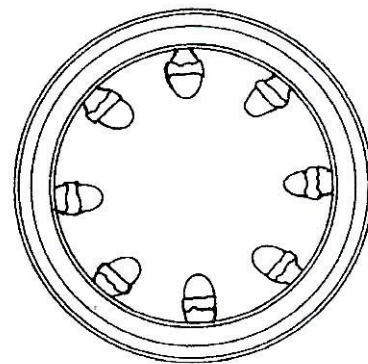


8. The labeled part that provides surface for the attachment of the triceps is attachment of the triceps is?

- A. I
- B. II
- C. III
- D. IV

9. The diagram below illustrates the transverse section of a

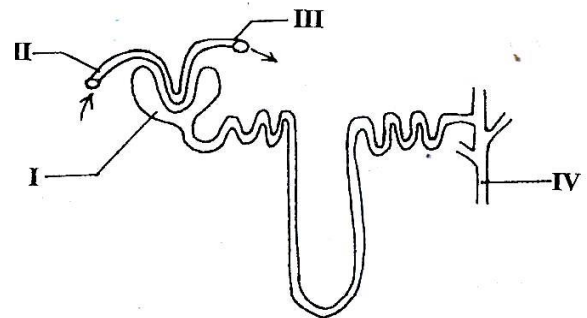
- A. Dicotyledonous root
- B. Monocotyledonous root
- C. Dicotyledonous stem
- D. Monocotyledonous stem



10. Which of the following actions does not occur during exhalation in man?

- A. Thoracic cavity decreases in volume
- B. Diaphragm flattens
- C. Ribs move down and in
- D. Air pressure increases in the thoracic cavity

SThe diagram below is an illustration of the urinary tubule in a mammal. Study it and answer questions 12 to 14.



11. Which of the following substances is found in the part labeled II only?

- A. Lipid
- B. Protein
- C. Water

D. Salt

12. The part which contains the lowest concentration of urea is labeled?

A. I

B. II

C. III

D. IV

13. Which of the following substances is greater in concentration in the part labeled IV when compared to that labeled I?

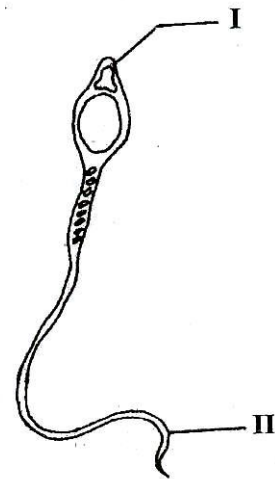
A. Blood sugar

B. Glycogen

C. Bile

D. Urea.

The diagram below is an illustration of the human sperm. Study it and answer questions 14 and 15.



14. The part labeled I is the?

A. Acrosome

B. Nucleus

C. Mitochondrion

D. Tail.

15. The function of the part labeled II is to?

A. Acrosome

B. Nucleus

C. Mitochondrion

D. Tail