APPENDIX 1

Lesson plans developed based on the REACT Strategy of learning

Lesson plan 1

Topic: CELL II

Subtopic: Nuclei acids
Specific objectives: By the end of the lesson the student will be able to:

i. explain the term nucleic acid.
ii. name the types of nucleic acids.
iii. describe the double helix model of the structure of DNA.
iv. describe the structure of RNA.
v. outline the process of DNA replication.

Teaching/Learning material: Models of the structure of DNA and RNA and video on DNA replication.

Relating

1. Students are given a reading text on the application of the concept of nucleic acids in everyday life to read.
2. Students respond to questions asked based on the reading text to activate students' prior knowledge on the concepts of nucleic acid, the structure of DNA and RNA and DNA replication.

Experiencing

1. Students form groups of four and each group uses the school library and the internet to explore the concept of nucleic acid, types of nucleic acid, the structure of DNA and RNA and DNA replication.
2. Members of each group of students present their findings to the whole class for the other groups to assess and make corrections to their findings on the concepts they presented on.
3. Students observe models of the structure of DNA and RNA and watch videos of the mechanism of DNA replication.

Main concepts

1. Nucleic acid is a complex substance found in the nucleus of cells that consists of nucleotides connected in a long chain.
2. The two types of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
3. The unit structure of DNA is called nucleotide which is made up of sugar, phosphate and nitrogenous bases. There are two types of nitrogenous bases; purines (Adenine [A] and Guanine [G]) and pyrimidines (Cytosine [C] and Thymine [T]). Two polynucleotide strands twisted about each other form the DNA. The two strands run in opposite directions which makes the pairing of the bases possible. The adenine pairs with thymine and cytosine always pair with guanine.

Hydrogen bonds link the bases. There are two hydrogen bonds between A and T and three hydrogen bonds between C and G.

4. RNA is made up of a single strand polynucleotide. In RNA the base thymine is replaced by the base Uracil [C]. There are three types of RNA, these are, messenger RNA (mRNA), transfer RNA (tRNA) and ribosomal RNA (rRNA).
5. DNA replication occurs before cell division. Weak hydrogen bonds holding the two strands of DNA are broken under the influence of helicase, as a result, the DNA unwinds into two strands. Free nucleotides in the nucleus assemble alongside each half strand to form two pairs of half strands. Hydrogen bonds between complementary base pairs join the half strands to form two identical double strands of DNA. The roles enzymes involved in DNA replication are; helicase breaks the hydrogen bonds to unwind the DNA strand, polymerase makes a copy of the DNA in the 5′ to 3′ direction on the leading strand and ligase binds Okazaki fragments on the lagging strand.

Applying

1. Students form groups of four and each group of students select five nitrogenous bases and construct:
   a. DNA molecule consisting of five nucleotides using the bases they selected.
   b. RNA molecule consisting of five nucleotides using the bases they selected.
2. Students answer few questions about the mechanism of DNA replication based on a scenario created by the teacher.

Cooperating

1. Students form groups of two and through think-pair-share, they construct a Venn diagram on the difference between DNA and RNA and present their diagram to the class.
2. Students form groups of four members and each group of students discusses what will happen when a particular enzyme is absent during DNA replication and present their responses to the class.

Transferring

As homework, each student finds out the importance of DNA replication in living things and present their findings class for the whole class to assess.

Lesson plan 2

Topic: CELL II

Subtopic: Transcription and translation

Specific objectives: By the end of the lesson the student will be able to:

i. outline the process of RNA transcription.
ii. describe the process of translation.
iii. explain the importance of translation in living things.

Teaching/Learning materials: Videos on transcription and translation.

Relating

1. Students are given reading text on the concept of transcription, translation and the importance of translation in everyday life.

2. Students respond to questions asked based on the reading text to activate students' prior knowledge on the concepts of transcription, translation and the importance of translation. Example:
    a) Question: what nitrogenous bases are found in RNA molecules?
    b) Response: the nitrogenous bases found in RNA molecules are adenine, cytosine, guanine and uracil.

Experiencing

1. Students form groups of four and each group explore on the concept of transcription, translation and importance of translation using textbooks, library book and the internet.
2. Members of each group of students present their findings to the whole class for the other groups to assess and make corrections to their findings on the concepts they presented on.
3. Students watch videos of the transcription and translation.

Main concepts

1. **Transcription:** A specific region of DNA molecule unzips to expose a sequence of base triplets for the synthesis of a particular protein. Free ribonucleotides now form a new strand as in DNA replication except that the new strand is made up of mRNA. The mRNA molecule formed is complementary to the coded message on the DNA strand on which it was produced. The mRNA moves out of the nucleus through a nuclear pore into the cytoplasm and becomes attached to a ribosome.
2. **Translation:** Messenger RNA moves out of the nucleus of the cell into the cytoplasm where it associates itself with ribosomes and forms a site for the synthesis of protein, as it carries the template from the DNA. Transfer RNA folds to form a branched-chain. One end of the transfer RNA links up with a specific amino acid during protein synthesis. A sequence of three bases called anticodon occurs at a point along the transfer RNA chain. The anticodon of each transfer RNA matches up alongside its complementary three bases called codon on the messenger RNA. Simultaneously, the amino acids on the transfer RNA link up with another amino acid already in place on the messenger RNA by a peptide link. This process continues as a chain of amino acids (polypeptide chain) is formed. When the process ends, the polypeptide chain formed moves from the transfer RNA into the cytoplasm of the cell and links up with other polypeptide chains to form a protein molecule.
3. **Importance of translation:** protein helps in building and repairing tissues, proteins are used in making enzymes and hormones and proteins are building blocks of bones, blood, skin and muscle.

Applying

3. Students form groups of four and each group of students will be a printed image of DNA molecules with different sequences bases to construct:
    a. RNA molecules that would be transcribed from their various DNA molecules.
    b. Students answer few questions about the mechanism of translation and the importance of translation based on a scenario created by the teacher.

Cooperating

1. Students form groups of four and use a diagram to describe how protein is synthesised from a DNA molecule in the cell of an organism.
3. Through discussion, each group of students explain why cells must produce protein.

Transferring

1. Individual students find out the sources of amino acids used for protein synthesis in the cells. And also, students to find out how transcription and translation lead to variations in traits of humans. The whole class assess the findings the students obtained.

APPENDIX 2

Lesson plan developed based on the conventional approach

Lesson plan 1
Topic: CELL II
Subtopic: Nucleic Acids
Specific objectives: By the end of the lesson the student will be able to:

i. explain the term nucleic acid.
ii. name the types of nucleic acids.
iii. describe the double helix model of the structure of DNA.
iv. describe the structure of RNA.
v. outline the process of DNA replication.

Relevant previous knowledge: E.g., students have learnt about the parts and functions of cells, therefore; they will be able to mention the parts of the cell where genetic materials are stored.
Teaching/Learning materials: Model of the structure of DNA, video on DNA replication, computer and projector.

Introduction

Teacher activity: The teacher uses questions to review students' relevant previous knowledge. E.g., Which part of a cell are genetic material located?
Student Activity: Students respond to the teacher's questions. E.g., Genetic materials are found in the nucleus of the cell.

Content Development

Step 1: Meaning of nucleic acid and types of nucleic acid.
Teacher activity:

a. The teacher asks students to brainstorm to come up with the meaning of nucleic acids.
b. The teacher asks students to come up with the types of nucleic acids.

Student activity:

a. Students brainstorm to come up with the meaning of nucleic acid.
b. Students brainstorm to come up with the types of nucleic acid.

Step 2: The structure of DNA and RNA
Teacher activity: Through the use of the model of the structure of DNA, the teacher discusses with students to describe the structure of DNA and RNA.
Student activity: students observe the model of DNA structure and participate in the discussion.
Step 3: DNA replication
Teacher activity: Through the use of video on DNA replication, the teacher discusses with students to describe the mechanism of DNA replication and the enzymes involved in DNA replication.
Student activity: students watch a video on DNA replication and participate in the discussion.

Main Ideas

1. Nucleic acid is a complex substance found in the nucleus of cells that consists of nucleotides connected in a long chain.
2. The two types of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
3. The unit structure of DNA is called nucleotide which is made up of sugar, phosphate and nitrogenous bases. There are two types of nitrogenous bases; purines (Adenine [A] and Guanine [G]) and pyrimidines (Cytosine [C] and Thymine [T]). Two polynucleotide strands twisted about each other form the DNA. The two strands run in opposite directions which makes the pairing of the bases possible. The adenine pairs with thymine and cytosine always pair with guanine. Hydrogen bonds link the bases. There are two hydrogen bonds between A and T and three hydrogen bonds between C and G.
4. RNA is made up of a single strand polynucleotide. In RNA the base thymine is replaced by the base Uracil [C]. There are three types of RNA, these are, messenger RNA (mRNA), transfer RNA (tRNA) and ribosomal RNA (rRNA).
5. DNA replication occurs before cell division. Weak hydrogen bonds holding the two strands of DNA are broken under the influence of helicase, as a result, the DNA unwinds into two strands. Free nucleotides in the nucleus assemble alongside each half strand to form two pairs of half strands. Hydrogen bonds between complementary base pairs join the half strands to form two identical double strands of DNA. The roles enzymes involved in DNA replication are; helicase breaks the hydrogen bonds to unwind the DNA strand, polymerase makes a copy of the DNA in the 5′ to 3′ direction on the leading strand and ligase binds Okazaki fragments on the lagging strand.

Application

Teacher activity: The teacher creates a scenario for students to apply what they have learnt. For example, which of these DNA double helix will be more difficult to unwind into two strands: DNA made up of more Adenine – Thymine base pair or DNA made up of more Guanine – Cytosine base pair? Why?
Student activity: students respond to the teacher's question using what they have learned.

Closure

Teacher activity:

a. The teacher summarises the lesson.
b. The teacher evaluates the lesson using questions based on the set objectives.

Student activity: students listen to the teacher and respond to the teacher's question.

Assignment

Students are asked to do the following:

1. Draw and label the structure of DNA consisting of five (5) nucleotides.
2. Mention three differences between the structures of DNA and RNA.
3. Describe the process of DNA replication using diagrams.

Lesson plan 2

Topic: CELL II
Subtopic: Protein synthesis
Specific objectives: By the end of the lesson the student will be able to:

i. outline the process of RNA transcription.

ii. describe the process of protein synthesis.
iii. explain the importance of protein synthesis for living things.

Relevant previous knowledge: E.g., students have learnt about the structure of RNA therefore; they will be able to mention the nitrogenous bases in the RNA molecule.

Teaching/Learning materials: videos on RNA transcription and protein synthesis, cardboard.

Introduction

Teacher activity: The teacher uses questions to review students' relevant previous knowledge. E.g., What are the nitrogenous bases found in RNA molecules?

Student Activity: students respond to the teacher's questions. E.g., Adenine, uracil, cytosine and guanine.

Content development

Step 1: RNA transcription.

Teacher activity: Through the use of video on RNA transcription, the teacher discusses with students the process of RNA transcription and ask learners to practice RNA transcription on cardboards.

Student activity: Students watch a video on RNA transcription, participate in the discussion and practice RNA transcription on cardboards.

Step 2: Protein synthesis

Teacher activity: Through the use of video on protein synthesis, the teacher discusses the process of protein synthesis with students.

Student activity: Students watch a video on protein synthesis and participate in the discussion.

Step 3: Importance of protein synthesis

Teacher activity: The teacher asks students to brainstorm to come up with the importance of protein synthesis.

Student activity: Students brainstorm to come up with the importance of protein synthesis.

Main ideas

1. **Transcription:** A specific region of DNA molecule unzips to expose a sequence of base triplets for the synthesis of a particular protein. Free ribonucleotides now form a new strand as in DNA replication except that the new strand is made up of mRNA. The mRNA molecule formed is complementary to the coded message on the DNA strand on which it was produced. The mRNA moves out of the nucleus through a nuclear pore into the cytoplasm and becomes attached to a ribosome.
2. **Translation:** Messenger RNA moves out of the nucleus of the cell into the cytoplasm where it associates itself with ribosomes and forms a site for the synthesis of protein, as it carries the template from the DNA. Transfer RNA folds to form a branched-chain. One end of the transfer RNA links up with a specific amino acid during protein synthesis. A sequence of three bases called anticodon occurs at a point along the transfer RNA chain. The anticodon of each transfer RNA matches up alongside its complementary three bases called codon on the messenger RNA. Simultaneously, the amino acids on the transfer RNA link up with another amino acid already in place on the messenger RNA by a peptide link. This process continues as a chain of amino acids (polypeptide chain) is formed. When the process ends, the polypeptide chain formed moves from the transfer RNA into the cytoplasm of the cell and links up with other polypeptide chains to form a protein molecule.
3. **Importance of translation:** protein helps in building and repairing tissues, proteins are used in making enzymes and hormones and proteins are building blocks of bones, blood, skin and muscle.

Application

Teacher activity: The teacher creates a scenario for the students to apply what they have learned. For example, three messenger RNAs involved in the synthesis of a certain protein is having the codons CGA, GUC and GAC, what will be the bases of the anticodon that will pair with each of the codons?
Student activity: Students respond to the teacher's question using what they have learned.

Closure

Teacher activity: The teacher summarises the lesson and evaluates the lesson by asking questions based on the set objectives.
Student activity: Students take notes and respond to the teacher's questions.

Assignment

Students are asked to do the following exercise:
Describe the relationship among DNA, RNA and protein molecules.

APPENDIX 3

Instruments used in collecting the quantitative data

ACHIVEMENT TEST FOR THE PRETEST

A Test on the Diversity of Life and Life Processes in Living Things

For each of the questions, circle the correct answer from the four (4) options given.

1. The life process by which energy is released from the breakdown of food is termed as…….
   a. digestion
   b. excretion
   c. nutrition
   d. respiration
2. To which kingdom do insects belong?
   a. *Animalia*.
   b. *Plantae*.
   c. *Prokaryotae*.
   d. *Protoctista*.
3. Which of the following processes is **not** a characteristic of all living things?
   a. Excretion.
   b. Photosynthesis.
   c. Reproduction.
   d. Respiration.
4. Euglena is considered as both a plant and animal because it has ……..
   a. chloroplast and cytoplasm
   b. flagellum and chloroplast
   c. flagellum and nucleus
   d. flagellum and cytoplasm

5. From which of the following is the scientific name of an organism derived?
   a. Class and species.
   b. Family and species.
   c. Genus and species.
   d. Order and species.
6. Which of the following organisms exist in a colony?
   a. Amoeba.
   b. Chlamydomonas.
   c. Spirogyra.
   d. Volvox.
7. Which of the following statements about viruses is true?
   a. Viruses are bigger than bacteria.
   b. Viruses are living things.
   c. Viruses can only multiply inside a living cell.
   d. Viruses have a nucleus.
8. Air enters the tracheal system of the cockroach through the ……..
   a. cerci
   b. Malpighian tubules
   c. spiracles
   d. tracheoles
9. The egg of a butterfly hatches into larvae called a ……..
   a. caterpillar
   b. chrysalis
   c. nymph
   d. pupa
10. Which of the following statements about the cell wall of Spirogyra is true?
    a. It contains cellulose.
    b. It contains chitin.
    c. It contains chloroplast.
    d. It contains cytoplasm.

11. A mushroom digests food substances outside its body and then absorbs the nutrients. This mushroom is considered as?
    a. Autotrophic.

b. Heterotrophic.
c. Holozoic.
d. Saprophytic.

12. In which one of the following organisms does alternation of generation occurs?
    a. Cockroach.
    b. Moss.
    c. *Rhizopus*.
    d. *Spirogyra*.
13. Where are fertilized cockroach eggs stored?
    a. Cercus.
    b. Maxilla.
    c. Ommatidia.
    d. Ootheca.
14. In terms of the mode of nutrition, *Rhizopus* is considered as …….
    a. holophytic.
    b. holozoic.
    c. parasitic.
    d. saprophytic.
15. The bacterium is classified under the kingdom *Prokaryotae* because it……
    a. has a cell wall made of chitin
    b. lacks nuclear membrane
    c. is disease-causing organism
    d. possess mitochondrion
16. The main objective in the classification of living things is ……
    a. for easy identification and communication
    b. to demonstrate the diversity of living things
    c. to ensure that each organism is named properly
    d. to establish an evolutionary trend
17. Which of the following organisms exist as a cell?
    a. Amoeba.
    b. Moss.
    c. *Rhizopus*.
    d. Spirogyra.
18. What role does the wall of the zygospore of Spirogyra plays?
    a. It provides protection against drought.

b. It prevents the internal content from the ultraviolet ray of the sun.
c. It prevents the zygospore from being grazed upon.
d. It prevents the zygospore from developing.

19. The gametophyte of a fern ……..
a. forms gemmae
b. forms sporangia
c. has short roots
d. is multicellular

20. Amoeba is a unicellular organism that reproduces asexually by a process known as …….
a. binary fission
b. conjugation
c. gametangial fission
d. longitudinal fission

21. Select the correct sequence of ranking the taxa.
a. Class → Species → Family → Genus.
b. Class → Species → Genus → Family.
c. Class → Family → Species → Genus.
d. Class → Family → Genus → Species.

22. The taxon, order, comes in between……..
a. class and family
b. species and genus
c. species and family
d. family and genus

23. The Kingdom *Protoctista* include major phyla…….
a. *Bryophyta* and *Phaeophyta*
b. *Euglenophyta* and *Ascomycota*
c. *Rhizopoda* and *Chlorophyta*
d. *Zoomastigina* and *Lycophyta*

24. Which of the following is the highest taxa in the classification of plants?
a. Class.
b. Division.
c. Order.
d. Phylum.

25. To which kingdom do arthropods belong?
a. *Animalia*.

b. *Plantae*.

c. *Prokaryotae*.

d. *Protoctista*.

26. Which of the following features in Euglena is typical of plant cells?

a. Chloroplast.

b. Eyespot.

c. Flagellum.

d. Pellicle.

27. Paramecium has two ……..

a. anal pores

b. cytostomes

c. Gullets

d. Nucleus

28. The division of a single cell to produce two identical cells in unicellular organisms is called …….

a. binary fission

b. columella

c. Conjugation

d. Sporulation

29. Which of the following is **not** characteristic of dicotyledons?

a. Flower parts are in multiples of three.

b. Net-veined leaves.

c. Seeds with two cotyledons.

d. Taproot system.

30. To which of the following groups do mosses belong?

a. Bryophytes

b. Conifers.

c. Cycads

d. Ferns.

ACHIEVEMENT TEST FOR POSTTEST

A Test on DNA, RNA and protein synthesis

Answer all questions. For each of the questions, circle the correct answer from the four (4) options given.

1. DNA and RNA are made up of nucleotides. Each of the nucleotides consists of ……..., ……, and …….....

   a. side chain, carboxyl group, glucose
   b. side chain, sugar, nitrate group
   c. sugar, nitrogenous base, a carboxyl group
   d. sugar, nitrogenous base, a phosphate group

2. identify the four nitrogenous bases found within ribonucleic acid.

   a. adenine, thymine, cytosine, guanine
   b. adenine, thymine, guanine, uracil
   c. adenine, uracil, guanine, cytosine
   d. adenine, uracil, phosphate, ribose

3. DNA contains deoxyribose sugar whiles RNA contains……...

   a. fructose sugar.
   b. galactose sugar.
   c. lactose sugar.
   d. ribose sugar.

4. Which of these statements best explains the form and purpose of one kind of nucleic acid?

   a. DNA, a double helix, functions primarily as an archive of genetic information.
   b. DNA, a single helix, functions primarily as an archive of genetic information.
   c. RNA, a double helix, functions primarily as an archive of genetic information.
   d. RNA, a single helix, functions primarily as an archive of genetic information.

5. DNA and RNA differ in such a way that each of them uses different ……. within their nucleotides.

   a. Base pair.
   b. Hydrogen bond.
   c. phosphate
   d. Sugars.

6. The DNA in living things is ……. which results in the production of mRNA.

   a. Duplicated
   b. Replicated
   c. Transcribed
   d. Translated

7. The molecule that is important in translating the triplet codons of mRNA into the protein molecules is the ……

   a. DNA
   b. RNA
   c. rRNA
   d. tRNA

8. Which of the following statements is **true**?

a. During transcription, the mRNA is synthesized in the 3’ to 5’ direction.
b. The mRNA is translated from 5’ to the 3’ end.
c. The mRNA is translated from 3’ to 5’ end.
d. The mRNA is translated irrespective of direction.

9. How does the enzyme called helicase function?

a. It adds new nucleotides to the DNA helix.
b. It forms bonds between DNA nucleotides.
c. It forms the DNA helix.
d. It separates DNA strands.

10. Which of the following removes the RNA primer during replication?

a. DNA ligase.
b. DNA polymerase I.
c. Helicase.
d. RNA primase.

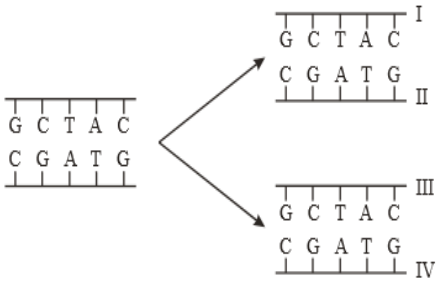
11. A biochemist isolated and purified molecules needed for DNA replication. When some DNA was added, replication occurred, but the DNA molecules formed were defective. Which of the following had been left out of the mixture?

a. Helicase
b. Ligase
c. Nucleotides
d. Polymerase

12. Proofreading and repair in DNA replication happen ……

a. at any time during and after the synthesis of DNA.
b. only before DNA synthesis.
c. Only in the presence of an excision repair mechanism.
d. Only in the presence of DNA polymerase.

13. The following picture shows a short section of a DNA molecule before and after replication. Which strands in the two replicated DNA are from the original DNA?



a. I and II
b. II and III
c. III and IV
d. I, II, III and IV

14. Which of the following is **not** a component of a nucleic acid?

a. Base pair.
b. Hydrogen bond.
c. Peptide bond.

d. Ribose sugar.

15. DNA replication occurs in a cell during ……

a. interphase of mitosis
b. metaphase of meiosis I
c. anaphase of mitosis
d. prophase of mitosis

16. Which of these nitrogenous bases is **not** found in DNA?

a. Adenine.
b. Cytosine.
c. Guanine.
d. Uracil.

17. What is produced during transcription?

a. DNA molecules
b. RNA molecules
c. RNA polymerase
d. protein molecules

18. Which of the following is **true** about codons and amino acids?

a. Each amino acid is specified by only one codon.
b. Each codon specifies a different amino acid.
c. Several different codons can specify the same amino acid.
d. Some amino acids have no link to a codon.

19. During translation, the type of amino acid that is added to the growing polypeptide depends on the……

a. codon on the messenger RNA and the anticodon on the ribosomal RNA.
b. anticodon on the messenger RNA and the anticodon on the transfer RNA.
c. anticodon on the ribosomal RNA and the codon on the messenger RNA.
d. codon on the messenger RNA and the anticodon on the transfer RNA.

20. In eukaryotes, transcription takes places in…….

a. the cytoplasm
b. the mitochondrion
c. the nucleus
d. the ribosome

21. The two strands of DNA must run in……. direction(s) and must be ……. if they are to bond with each other.

a. opposite; complementary
b. parallel; not complementary
c. parallel; complementary
d. the same; not complementary

22. Which of the following nucleotide sequences represents the complement to the DNA strand 5′ – AGATCCG - 3′?

a. 3′ – AGATCCG - 5′
b. 3′ – CTCGAAT - 5′
c. 3′ – TCTAGGC - 5′
d. 5′ – CTCGAAT - 3′

23. Which type of RNA is made from deoxyribonucleic molecules?

a. All the RNAs.
b. mRNA.
c. rRNA.
d. tRNA.

24. Which of the following serves as a “connector” in protein synthesis and bridges the gap between mRNA and proteins?

a. DNA sequences.
b. promoter sequences.
c. rRNA sequences.
d. tRNA sequences.

25. Which of the following is the function of ribosomes during translation?
Ribosomes…….…….

a. attach to the mRNA molecule and travel along its length.
b. attach to the DNA and travel along its length to produce an mRNA molecule.
c. translate mRNA into tRNA.
d. transcribe mRNA to tRNA.

26. One of the mRNA codons specifying a certain amino acid is 5′-CUA-3′. What will be the anticodon for this codon?

a. 3′-AUC-5′.
b. 3′-GAT-5′.
c. 3′-GAU-5′.
d. 5′-GAT-3′.

27. Which of the following base pairing is **not** possible to occur in nucleic acids?

a. A pairing with T
b. A pairing with U
c. G pairing with C
d. G pairing with U

28. A double-stranded Deoxyribonucleic acid has 20 per cent of Thymine, what will be the percentage of Cytosine of this nucleic acid?

a. 20%
b. 30%
c. 40%
d. 50%

29. Which of the following is responsible for the addition of new nucleotides to a growing DNA strand?

a. DNA polymerase
b. DNA helicase
c. RNA primer
d. Primase

30. Which of the following organelles is **not** associated with protein synthesis from DNA?

a. Cytoplasm
b. Nuclear membrane
c. Nucleus
d. Plasma membrane

The instrument used in the collection the qualitative data

The questions for the semi-structured interview are:

1. what are the positive aspects of the teaching style used to teach this topic?
2. what are the negative aspects of the teaching style used to teach this topic?
3. what are your thoughts about learning in groups?

APPENDIX 4

Descriptive Statistics of ANOVA for Pretest Scores

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
REACT LOW	14	14.57	3.502	.936	12.55	16.59	8	18
REACT HIGH	13	22.00	2.677	.742	20.38	23.62	19	27
CONVENT LOW	14	14.29	2.758	.737	12.69	15.88	10	18
CONVENT HIGH	16	21.38	2.473	.618	20.06	22.69	19	28
Total	57	18.11	4.597	.609	16.89	19.32	8	28

Descriptive Statistics of ANOVA for Posttest Scores

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
REACT LOW	14	14.07	2.702	.722	12.51	15.63	10	20
REACT HIGH	13	19.08	2.362	.655	17.65	20.50	15	24
CONVENT LOW	14	10.14	3.134	.838	8.33	11.95	6	16
CONVENT HIGH	16	13.69	2.600	.650	11.30	14.07	8	16

Total	57	13.86	4.142	.549	12.76	14.96	6	24

Post Hoc Analysis of Pretest of REACT Low, REACT High, Conventional Low and Conventional High Achievers' Groups

		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
(I) GROUP	(J) GROUP				Lower Bound	Upper Bound
REACT LOW	REACT HIGH	-7.429*	1.105	.000	-10.46	-4.40
	CONVENT LOW	.286	1.084	1.000	-2.69	3.26
	CONVENT HIGH	-6.804*	1.050	.000	-9.68	-3.93
REACT HIGH	REACT LOW	7.429*	1.105	.000	4.40	10.46
	CONVENT LOW	7.714*	1.105	.000	4.69	10.74
	CONVENT HIGH	.625	1.071	1.000	-2.31	3.56
CONVENT LOW	REACT LOW	-.286	1.084	1.000	-3.26	2.69
	REACT HIGH	-7.714*	1.105	.000	-10.74	-4.69
	CONVENT HIGH	-7.089*	1.050	.000	-9.97	-4.21
CONVENT HIGH	REACT LOW	6.804*	1.050	.000	3.93	9.68
	REACT HIGH	-.625	1.071	1.000	-3.56	2.31
	CONVENT LOW	7.089*	1.050	.000	4.21	9.97

*Significant @ $p < 0.05$.

Post Hoc Analysis of Posttest of REACT Low, REACT High, Conventional Low and Conventional High Achievers' Groups

		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
(I) GROUP	(J) GROUP				Lower Bound	Upper Bound
REACT LOW	REACT HIGH	-5.005*	1.046	.000	-7.87	-2.14
	CONVENT LOW	3.929*	1.027	.002	1.11	6.74
	CONVENT HIGH	.384	.767	1.000	-1.34	4.11
REACT HIGH	REACT LOW	5.005*	1.046	.000	2.14	7.87
	CONVENT LOW	8.934*	1.046	.000	6.07	11.80
	CONVENT HIGH	5.389*	.955	.000	3.61	9.17
CONVENT LOW	REACT LOW	-3.929*	1.027	.002	-6.74	-1.11
	REACT HIGH	-8.934*	1.046	.000	-11.80	-6.07
	CONVENT HIGH	-3.545*	.884	.008	-5.27	.18
CONVENT HIGH	REACT LOW	-1.384	.767	1.000	-4.11	1.34
	REACT HIGH	-6.389*	.955	.000	-9.17	-3.61
	CONVENT LOW	3.545*	.884	.008	-.18	5.27

*Significant @ $p < 0.05$.