Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:\_\_\_\_\_\_\_\_\_\_\_

**AP Insight Quiz for Unit 7 Part 1**

**DNA History, Structure, and Replication**

**1.** Scientist Frederick Griffith performed an experiment in 1928 in which harmless pneumococcal bacteria were changed into a deadly strain by what Griffith identified as a “transforming principle.” The results of the Griffith experiment are shown in the diagram below.

In 1944, scientists Oswald Avery, Colin MacLeod, and Maclyn McCarty were able to isolate the “transforming principle” and test it. Chemical analysis showed that the compound contained carbon, hydrogen, nitrogen, and phosphorus. The scientists then exposed the compound to several hydrolytic enzymes. The results of the scientists’ experiment are shown in the table below.



Which statement **best** describes how the result of the Avery-MacLeod-McCarty experiment provided insight into the observation made in the Griffith experiment?

(A) The results of the Avery-MacLeod-McCarty experiment show that DNA is the “transforming principle” and that the DNA codes for RNA or proteins.

(B) The results of the Avery-MacLeod-McCarty experiment show that proteins cannot be the “transforming principle” since the proteins are easily broken down by many substances.

(C) The results of the Avery-MacLeod-McCarty experiment show that DNA is the “transforming principle” because enzymes that disable DNA make the “transforming” compound nonfunctional.

(D) The results of the Avery-MacLeod-McCarty experiment show that the “transforming principle” has a double-helix structure because only the double helix can resist trypsin, chymotrypsin, and ribonuclease.

**2.** In 1952, scientists Alfred Hershey and Martha Chase performed an experiment using bacteriophages (viruses that infect bacteria) to determine the source of genetic material found in organisms. Bacteriophages are composed of a protein shell and DNA. One group of bacteriophages was exposed to the radioactive isotope sulfur-35 (35S) and another group of bacteriophages was exposed to the radioactive isotope phosphorus-32 (32P). The radioactive sulfur-35 effectively labeled the protein in the bacteriophages because only the protein, not DNA, contains the element sulfur, and the radioactive phosphorus-32 effectively labeled the DNA in the bacteriophages because only DNA, not the protein, contains the element phosphorus. The bacteriophages were then allowed to infect bacterial cultures, as shown in the diagram below.



After infection, the bacterial cultures were placed in a blender and then centrifuged to separate the phage shells and media (surrounding fluid) from the bacteria. Upon analysis of the centrifuged material, the following observations shown in the table below were noted.



Which conclusion is **best** supported by the results of the Hershey-Chase experiment?

(A) Nucleic acids are the genetic material in cells, because phosphorus is a component of nucleic acids and is transferred from the phages to the bacterial cells.

(B) Sulfur is an important component of genetic material in phages but not in bacterial cells, because sulfur remains in the viruses and is not observed in the bacteria.

(C) Phosphates are a key genetic material in cells, because phosphorus is transferred from the phages to bacterial cells, and phosphorus is a component of the phosphate-sugar chains that carry the genetic code.

(D) Phosphorus is the genetic material found in cells, because phosphorus is transferred from the phage to the bacterial cells and can therefore be used to alter cell activities.

**3.** The diagram below represents the replication of a DNA strand.



Which statement **best** explains how the DNA polymerases will interact with the DNA strands?

(A) As the replication fork opens, both DNA polymerases will continue to move toward the replication fork and attach complementary DNA nucleotides to each template strand, because DNA can only be replicated by enzymes moving toward the replication fork, in either the 3*'* 5*'* or 5*'* 3*'* direction.

(B) As the replication fork opens, only the DNA polymerase on the left strand of the molecule will be able to place complementary bases on the DNA template, because DNA can only be replicated by enzymes moving in the 3*'* 5*'* direction on the template strand.

(C) As the replication fork opens, the DNA polymerase on the left strand of the molecule will place complementary bases on the DNA template moving toward the replication fork, and the DNA polymerase on the right strand of the molecule will replicate moving away from the replication fork, because DNA can only be replicated by enzymes moving in the

3*'* 5*'* direction on the template strand.

(D) As the replication fork opens, the DNA polymerase on the left strand of the molecule will place complementary bases on the DNA template strand moving away from the replication fork, and the DNA polymerase on the right strand of the molecule will replicate moving toward the replication fork, because DNA can only be replicated by enzymes moving in the 5*'* 3*'* direction.

**4.** In the DNA replication diagrams shown below, the dark strands represent the original DNA from

the parent cell, and the light strands represent newly synthesized DNA.



Which statement identifies the diagram that **best** illustrates the semi-conservative model of DNA replication and explains how this method of DNA replication accurately transmits heritable material from one generation to the next?

(A) Diagram A, because the entire double helix serves as a template for the first new strand, ensuring that genetic information is accurately transmitted by keeping the original DNA molecule intact

(B) Diagram A, because a hybrid double helix of old and new DNA strands is never created, ensuring that genetic information is accurately transmitted by only pairing compatible DNA strands in a double helix, new with new and old with old

(C) Diagram B, because one strand of the original DNA helix serves as a template for each of the new strands in the new molecule, ensuring that genetic information is accurately transmitted by pairing a new strand with an original strand, against which errors can be checked

(D) Diagram B, because the strands in the original double helix are equally divided during the first replication, ensuring that genetic information is accurately transmitted by maintaining an equal split of old and new strands in each subsequent DNA molecule that is created