1) Which type of RNA would you expect to find where in the cell?

<table>
<thead>
<tr>
<th>RNA Type</th>
<th>Nucleus</th>
<th>Cytosol</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRNA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tRNA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rRNA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Define the following terms and state what process in biology they refer to:

<table>
<thead>
<tr>
<th>Term</th>
<th>Refers to...</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>semi-conservative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>degenerate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluid-mosaic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-competitive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mendelian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dihybrid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complementary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Which of the following are associated with mitosis?

   I. Tissue repair  
   II. Chiasmata  
   III. Asexual reproduction

A. I and II only  
B. I and III only  
C. II and III only  
D. I, II, and III

9. What can be concluded on the basis of the following karyotype?

A. Female with a normal set of chromosomes  
B. Male with Down syndrome  
C. Female with Down syndrome  
D. Male with a normal set of chromosomes
6. Which events take place in DNA replication?

I. Formation of messenger RNA
II. Unwinding of DNA double helix
III. Formation of complementary strands by DNA polymerase

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

10. What are homologous chromosomes?

A. Two chromosomes with differing sets of genes, in the same sequence, with the same alleles
B. Two chromosomes with the same set of genes, in a different sequence, with the same alleles
C. Two chromosomes with a different set of genes, in the same sequence, with different alleles
D. Two chromosomes with the same set of genes, in the same sequence, sometimes with different alleles

29. In *Drosophila* the allele for normal wings (W) is dominant over the allele for vestigial wings (w) and the allele for normal body (G) is dominant over the allele for ebony body (g). If two *Drosophila* with the genotypes Wwgg and wwGg are crossed together, what ratio of phenotypes is expected in the offspring?

A. 9 × normal wings, normal body : 3 × normal wings, ebony body : 3 × vestigial wings, normal body : 1 × vestigial wings, ebony body
B. 3 × normal wings, normal body : 3 × normal wings, ebony body : 3 × vestigial wings, normal body : 1 × vestigial wings, ebony body
C. 3 × normal wings, normal body : 1 × normal wings, ebony body : 3 × vestigial wings, normal body : 1 × vestigial wings, ebony body
D. 1 × normal wings, normal body : 1 × normal wings, ebony body : 1 × vestigial wings, normal body : 1 × vestigial wings, ebony body
11. Which features of DNA fragments are used to separate them in the process of gel electrophoresis?
   A. Their charge and their size
   B. Their charge and base composition
   C. The sequence of their bases and their charge
   D. Their base composition and their size

12. Which feature of a genetic pedigree chart demonstrates that a characteristic is sex linked?
   A. Numbers of offspring carrying the characteristic decreased over several generations.
   B. One gender is more commonly affected than the other.
   C. Equal numbers of males and females inherit the characteristic.
   D. Boys and girls only inherit the characteristic from their mothers.

19. Which processes are represented by the labels in the diagram below?

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A phagocyte ingesting a microbe by exocytosis.</td>
<td>Digestion of the microbe with the help of the Golgi apparatus.</td>
</tr>
<tr>
<td>B</td>
<td>A phagocyte ingesting a microbe by endocytosis.</td>
<td>Digestion of the microbe with the help of a lysosome.</td>
</tr>
<tr>
<td>C</td>
<td>A phagocyte ingesting a microbe by exocytosis.</td>
<td>Digestion of the microbe with the help of a lysosome.</td>
</tr>
<tr>
<td>D</td>
<td>A phagocyte ingesting a microbe by endocytosis.</td>
<td>Digestion of the microbe with the help of the Golgi apparatus.</td>
</tr>
</tbody>
</table>
24. Which stage of translation is illustrated by the diagram below?

A. Termination
B. Initiation
C. Translocation
D. Elongation
2. What is a difference between plant and animal cells?

A. Animal cells burst when they take in excess water by osmosis whereas plant cells do not.
B. Plant cells store cellulose whereas animal cells store starch.
C. Animal cells have ribosomes whereas plant cells do not.
D. Plant cells have a cell wall whereas animal cells have a cell membrane.

30. What constitutes a linkage group?

A. Genes whose loci are on different chromosomes
B. Genes carried on the same chromosome
C. Genes controlling a polygenic characteristic
D. Genes for the inheritance of ABO blood groups

31. What are the possible outcomes of recombination?

I. A different combination of unlinked genes not seen in the parents
II. A different combination of linked genes not seen in the parents
III. The same combination of genes seen in the parents

A. I and II only
B. I and III only
C. II and III only
D. I, II and III
3. What ensures that mitosis produces two genetically identical nuclei?
   A. One of each of the twenty-three types of chromosome is pulled to each pole of the cell by spindle microtubules.
   B. Half of the chromosomes are pulled to each centriole by mesosomes.
   C. Identical chromatids are pulled to opposite poles by spindle microtubules.
   D. DNA molecules are moved to the equator of the cell where they are replicated.

6. When substrate concentration increases, in a reaction catalysed by an enzyme, why does the rate of reaction increase?
   A. The substrate molecules collide more frequently with the active site.
   B. There are more active sites to catalyse the reaction.
   C. The substrate molecules are moving faster.
   D. There are more substrate molecules to catalyse the reaction.

7. If a polypeptide consists of 240 amino acids, what is the minimum number of nucleotides needed on the sense strand of a gene to code for it?
   A. 80
   B. 240
   C. 720
   D. 1440

8. What are the final products when a diploid onion cell, containing 16 chromosomes, undergoes meiosis?
   A. 4 cells, each with 8 chromosomes
   B. 2 cells, each with 8 chromosomes
   C. 4 cells, each with 4 chromosomes
   D. 2 cells, each with 16 chromosomes
9. A gene in cattle controls whether horns develop or not. When cattle without horns are mated together, none of the offspring ever have horns. A male with horns is mated with females without horns. If half of the offspring have horns and half do not, what is the conclusion?

A. The male is homozygous dominant.
B. The male is homozygous recessive.
C. The male is heterozygous.
D. Only males have horns.

10. Hemophilia is sex-linked and is caused by a recessive allele. A woman's father has hemophilia, but her husband does not.

What is the probability of the woman and her husband having a child with hemophilia?

<table>
<thead>
<tr>
<th>Probability of a son having hemophilia</th>
<th>Probability of a daughter having hemophilia</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 50%</td>
<td>0%</td>
</tr>
<tr>
<td>B. 0%</td>
<td>0%</td>
</tr>
<tr>
<td>C. 100%</td>
<td>0%</td>
</tr>
<tr>
<td>D. 0%</td>
<td>50%</td>
</tr>
</tbody>
</table>

23. Why are the messenger RNA molecules received by eukaryotic ribosomes shorter than the messenger RNA molecules formed by transcription of DNA?

A. Base deletion mutations make the mRNA shorter.
B. Start codons are not at the end of the mRNA molecule.
C. Introns are removed before the RNA is translated.
D. Bases are removed from the ends of the mRNA each time it is translated.

29. A cell replicates its DNA and then starts to divide by meiosis. What is the expected arrangement of chromosomes if crossing over has taken place between the two genes shown?

A. 

B. 

C. 

D. 

1. What are organelles?
   A. Small structures in the cytoplasm of a cell that all have more than one function.
   B. Membrane-bound structures found near the nucleus of all cells.
   C. Discrete structures found inside all cells that have specific functions.
   D. Specialized cells inside an organ that have one function.

2. Which organelles have a transport function?
   A. Ribosome and Golgi apparatus
   B. Golgi apparatus and endoplasmic reticulum
   C. Mitochondrion and endoplasmic reticulum
   D. Mitochondrion and ribosome

3. Which statements are characteristics of diffusion through membranes?
   I. Polysaccharides can be transported.
   II. It can be facilitated by special channels.
   III. It is affected by concentration gradients.
   A. I and II only
   B. I and III only
   C. II and III only
   D. I, II and III
9. What are the components of a eukaryotic chromosome?
   A. One DNA molecule and one large protein
   B. Many DNA molecules and many proteins
   C. One DNA molecule and many proteins
   D. Many DNA molecules and one large protein

10. How does the X chromosome differ from the Y chromosome in humans?
    A. The Y chromosome is longer.
    B. Some genes on the X chromosome are absent from the Y chromosome.
    C. The genes are the same but some on the Y chromosome are not expressed.
    D. The X chromosome determines sex.

11. What are the functions of the polymerase chain reaction?
    I. Copy fragments of DNA
    II. Amplify fragments of DNA
    III. Translate fragments of DNA
    A. I and II only
    B. I and III only
    C. II and III only
    D. I, II and III
13. The pedigree chart below shows the inheritance of a genetic disease in a family. What is the nature of the allele that causes this disease?

A. Dominant and sex linked
B. Dominant and non-sex linked
C. Recessive and sex linked
D. Recessive and non-sex linked

14. Which characteristics are used to identify chromosomes when constructing a karyotype?

I. The length of the chromosome
II. The position of the centromere on the chromosome
III. The pattern of bands on the chromosome
IV. The position of the chromosome on the spindle

A. I only
B. I and II only
C. I, II and III only
D. I, II, III and IV
5. What is an active site?
   A. The part of an enzyme that binds only to the product molecules.
   B. The sequence of amino acids responsible for the catalytic activity of enzymes.
   C. The sequence of amino acids responsible for the structure of an enzyme.
   D. The specific area responsible for the activity of all proteins.

22. Which statement describes how allosteric enzymes work?

<table>
<thead>
<tr>
<th></th>
<th>Reversible</th>
<th>Competitive inhibition</th>
<th>End-product inhibition</th>
<th>Active and inactive forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B.</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C.</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>D.</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

Key: ✓ = yes      × = no

30. Why is it sometimes difficult to identify how certain characteristics are inherited in humans.
   A. Most genes are linked.
   B. Rates of mutation are high.
   C. The inheritance may be polygenic.
   D. The environment varies so little.

1. Using a light microscope, what determines the ability to distinguish between two points lying close together?
   A. The magnification
   B. The preparation
   C. The fixation
   D. The resolution
3. Which of the following correctly describes exocytosis?

<table>
<thead>
<tr>
<th></th>
<th>Plasma membrane increases in size</th>
<th>Plasma membrane is pulled inwards</th>
<th>Membranes fuse</th>
<th>Vesicles move away from plasma membrane</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>B.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C.</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>D.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

5. What is one role of the element phosphorus?

A. It forms part of the structure of amino acids.
B. It forms part of the structure of fatty acids.
C. It forms part of the structure of ribose.
D. It forms part of the structure of nucleotides.

8. The diagram below represents a DNA nucleotide. What could the part labelled X represent?

A. Ribose
B. Uracil
C. Guanine
D. Phosphate
7. What determines the specificity of an enzyme for its substrate?

A. The temperature at which it is operating

B. The optimum pH of the enzymes

C. The concentration of the substrate

D. The structure of the enzyme molecule

27. In the bacterium *Escherichia coli* the DNA can be replicated at nearly 2000 base pairs per second. Human DNA is replicated at more than 5 million base pairs per second.

Why is the replication of human DNA so much faster?

A. Human cells have a higher concentration of DNA nucleotides in their cytoplasm.

B. Human cells have a faster form of DNA polymerase.

C. Human cells operate at a higher temperature.

D. Human cell DNA replication starts at several points simultaneously.

6. Which of the following represents the peptide linkage of a dipeptide?

![Dipeptide diagram]

A. I

B. II

C. III

D. IV
12. A gene has three alleles. How many different genotypes can be found for this gene?

A. 3  
B. 6  
C. 9  
D. 12

11. In the offspring what are the maternal and paternal pairs of chromosomes known as?

A. Sex chromosomes  
B. Autosomes  
C. Sister chromatids  
D. Homologous chromosomes