Unit 2 – Understanding Inheritance
Key Terms and Theory Review – *ANSWER KEY*

1) You receive a complete set of genes from each parent upon conception. Therefore, you will have two of each gene in every cell of your body (assuming no errors like nondisjunction happened).

2) Homologous pairs of chromosomes (pairs that are made up of one member from each parent) will separate during meiosis. This means that a single gamete (one sperm or one egg) will only get one copy of each chromosome.

3) They are similar in that they are the same size and carry the same genes. They differ in that they each come from a different parent, and that their alleles may be different (eg: both chromosomes will have the gene for eye colour, but one may have the dominant allele for brown, and the other may have the recessive allele for blue).

4) **Genotype** refers to the actual alleles that an individual has (ie: are they homozygous dominant, heterozygous, or homozygous recessive? BB, Bb, or bb?). It doesn't tell you what the trait in question looks like, only which genes are present. **Phenotype**, however, DOES tell you what the trait looks like, rather than which genes the person has. If someone has brown eyes, that is their **phenotype**. Their genotype might BB or Bb.

5) It's the other way around. It's a person's genes that cause their specific traits to appear. It isn't the trait that causes the genes to appear – that makes no sense! The **genotype** tells us which genes the person has, and those genes cause the **phenotype** that we see! So, no, I definitely don't agree with that statement! I hope you didn't, either!

6) This is because the dominant trait shows up as long as there's at least one dominant allele. So someone with brown eyes could be BB or Bb – we can't tell the difference just by looking at them. With blue eyes, there is only one option – bb – so we can tell their genotype easily.

7) (Basically – how do we know if they're AA or Aa?) We could carry out a **test cross** – we take the individual and breed them with someone who is **homozygous RECESSIVE** (aa). If all of the kids still show the dominant trait, the mystery person was AA. If some kids show the recessive trait as well, the mystery person was Aa.

8) If the gene is something dangerous (like one that causes a disease – cystic fibrosis, sickle cell anemia, etc.), you should know if you're a carrier because you WON'T show the symptoms of the condition, but could pass the gene on to your children in the future, putting them at risk of inheriting a harmful (or even lethal) condition.

9) Pairs of chromosomes, according to this law, all separate independently of each other during meiosis. If chromosome 1 from dad goes "left", that doesn't mean chromosome 2 from dad will do the same thing. Each homologous pair "does its own thing" and separates at random.

10) For polygenic traits, the phenotype we see often depends on how many dominant alleles the person has. If there are, say, three genes (A, B, and C), they could have ALL dominant alleles (AABBCC), no dominant alleles (aabbcc), and everything in between. Each combination leads to a change in the trait we see, and causes a wide range of phenotypes. For example, in skin colour, aabbcc would be VERY light skin, and AABBCC would be VERY dark skin. The combinations between those will vary from lighter, to medium, to darker.

11) Generally, incomplete dominance only leads to **three** different version of the trait, with one version being a "blend" between the other two (eg: red, pink, and white flowers; straight, wavy, and curly hair). For polygenic traits, you often see VERY many versions of the trait (eg: skin colour, hair colour).

12) Polygenic traits and incomplete dominance both showed that we can get a range of phenotypes, giving us more than the usual 2 (eg: brown eyes, or blue eyes; widow's peak or no widow's peak; tongue rolling or no tongue rolling). For codominance, there are still only two versions of a trait, but BOTH can show at the SAME TIME (eg: pink and white splotches of colour on flowers; white fur AND brown fur on cows at the same time).

13) It means that, instead of there being only two alleles (A or a, for example), there are three or more alleles, such as for blood type – the three alleles for that are I^A, I^B, and i.

14) Autosomes are those chromosomes carried equally by both genders (chromosomes 1 to 22). The sex chromosomes are those that determine gender and are not carried equally by both genders (females = XX, males = XY).

15) The sex chromosome carried by the sperm is what determines the gender. If the sperm is carrying an X chromosome, the child will be a girl. If it's carrying a Y chromosome, the child will be a boy.

16) Duchenne muscular dystrophy, red-green colour blindness, (some) diabetes insipidus, and hemophilia.

17) To be a carrier, one must be **heterozygous** (Aa, or for sex-linked traits, X^AX^a). Since men only possess a single X chromosome, it is not possible for them to be heterozygous – they will only have one copy of the given gene, not two (they can be X^AY or X^aY → neither of these is a carrier).

18) Because only females have a second (and sometimes unnecessary) X chromosome. The "spare" one can be shut off in some cells. For men, this cannot happen – shutting the one and only X chromosome down could have disastrous results!

19) Because it leads to new traits and, on a bigger scale, is responsible for the evolution of species.

20) During meiosis, homologous pairs of chromosomes (pairs where each member comes from a different parent) move close to each other in the cell. At times, they actually touch, and pieces of

these chromosomes can be exchanged. This leads to new combinations of genes on each chromosome that weren't possible before. When these chromosomes end up in new offspring, it increases the differences between them and their parents (ie: it increases genetic variation)!

21) Nondisjunction refers to an error in meiosis where homologous pairs of chromosomes DO NOT separate, and, instead, move together. When the cell divides to create gametes, this causes some cells to have too many copies of some chromosomes, and too few of others.

If it happens in meiosis I (the first stage of meiosis), then ***ALL*** of the gametes made from that cell will be affected (half of them will have extra chromosomes, half of them will be missing chromosomes). If it happens in meiosis II (the second stage of meiosis), then half of the gametes will be normal! (Of the other half, one of them will have an extra chromosome, and the other will be missing a chromosome).

22) If a gamete that is affected by nondisjunction ends up being used for conception, then the offspring produced will be missing chromosomes or carrying extra chromosomes in ALL of their body cells, potentially causing severe disorders.

23) Turner syndrome and Klinefelter syndrome are both aneuploidies that involve the X chromosome. In Turner syndrome, an individual is ***missing*** an X chromosome, so it is a type of ***monosomy*** (they are "XO" instead of "XX"). They appear female, but have under-developed reproductive organs, folds of skin around the neck, spots on their bodies, short stature, and other symptoms. Klinefelter syndrome involves males having an ***extra*** X chromosome (XXY). The symptoms include taller stature, less body hair, breast development, and infertility.

24) It means that the disorder involves an issue with an **autosome** – one of the 22 pairs of chromosomes that are NOT sex chromosomes. Specifically, in this case, the person has an extra copy of chromosome 21.

25) (Going in clockwise order, from top-left, to top-right, to bottom)

- Person has an extra X chromosome – this is XXY, or Klinefelter syndrome
- This person is male, but has 3 copies of chromosome 15 – we can call it "trisomy 15".
- This person is female and has 3 copies of chromosome 8 – we could call it "trisomy 8"!