

NETICS: Practice Problems:

name: SOLUTIONS

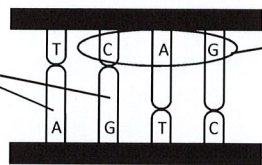
1) In your own words, define the following:

- a) Character trait: _____
- b) Chromosomes: _____
- c) Heredity: _____
- d) Gene: _____
- e) Pure-Breed: _____
- f) Cross-Breed: _____
- g) Genome: _____

See Notes

2) Identify the blanks:

a) Nitrogen Bases



b) (hint: 3 consecutive letters) Codon (Triplet)

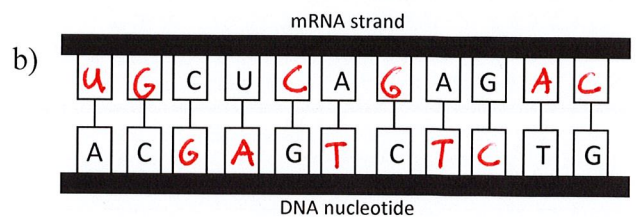
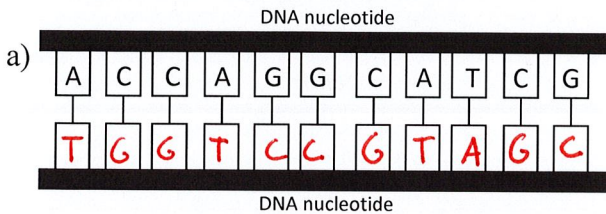
d) Humans have 46 chromosomes

c) Backbone structure.

e) Where are chromosomes found in a cell? Nucleus.

f) Guanine will pair with Cytosine.

3) Complete the following sequences:



4) Circle either True or False for each statement:

- T or F a) Nitrogen bases form the inside structure of a DNA strand
- T or F b) Genes are found on DNA.
- T or F c) Thymine can pair up with Adenine.
- T or F d) Cytosine can pair up with Cytosine.
- T or F e) Proteins are made up of folded DNA strands.
- T or F f) Nucleotides have a double helix shape.
- T or F g) DNA and RNA are the same.
- T or F h) Every chromosome contains one or more genes.
- T or F i) In a karyotype, chromosomes are found in pairs
- T or F j) Paired chromosomes (one from each parent) are called Homologous chromosomes.
- T or F k) Amino Acids chains are produced by ribosomes.

5) Using lines, match each description in column A with one corresponding term in column B

| <u>A</u> | <u>B</u> |
|-----------------------------------------------|----------------------|
| Constituent of a chromosome | Gene |
| Copies certain sequences code | Messenger RNA (mRNA) |
| Specific sequence and location on DNA | DNA |
| Half of a DNA strand | Nucleotide |
| Genetic structure visible under a microscope | Transfer RNA (tRNA) |
| Transports individual amino acids to ribosome | Chromosome |

6) You observe the Karyotype of 2 animals. One of these animals has a karyotype of 10 pairs of chromosomes. The other animal only has 8 pairs of chromosomes. What can be concluded about the 2 animals: not same species.

7) Our bodies contain thousands of genes.

a) What type of information is found on our genes:

info for character traits. & info for protein synthesis.

b) At the DNA level, what differs from one gene to another?

sequence of Nitrogen bases (A, C, T, G's)

8) In many TV crime series criminals are identified because of hair or blood traces they leave behind. Explain why blood or hair can be used to identify an individual.

Blood and Hair contain DNA. DNA is unique to every individual ("genetic fingerprint")

9) a) Define 'Protein': large molecules that play vital role in functioning of organism

b) Proteins are made from: folded amino acid chains (be precise)

c) Other than by their function, how do proteins differ from one and other? _____

sequence of Amino Acids, types of amino acids, & number of amino acids.

d) Give 3 different functions that proteins have. _____

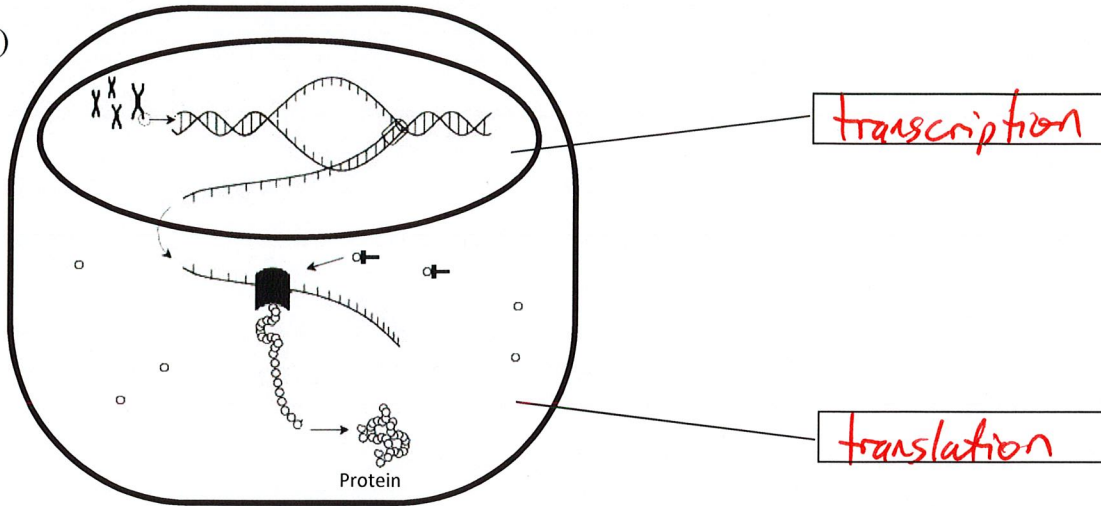
signaling proteins, transport proteins, structural protein, etc

e) Are the same amino acids use in the formation of Fish proteins as in Human proteins? Explain.

Yes, only 20 amino acids exist in nature.

f) Inside what structures are amino acid chains formed? Ribosomes

10)



- a) Place the following processes in the appropriate blank spaces: *Translation, Transcription*
- b) With the aid of the diagram, describe the process of protein synthesis in terms of what occurs during transcription and translation.

see Notes

11) You cross a pure-breed plant with a long stem and a pure-breed plant with a short stem. What name is given to the offspring? Hybrid (cross-breed)

12) Which of the following traits can be hereditary? (circle correct answers(s))

a) Smoker

b) Shape of nose

c) Ear size

d) Eye color

f) Certain diseases

g) Length of nails

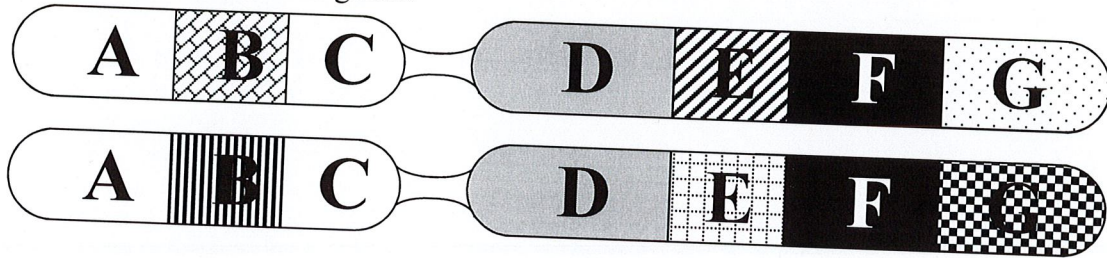
in your own words, define the following:

- a) Allele: _____
- b) Homozygote: _____
- c) Heterozygote: _____
- d) Dominant allele: _____
- e) Recessive allele: _____
- f) Genotype: _____
- g) Phenotype: _____

See Notes.

14) The following genotype codes a particular trait: **Gg**
G represents: Dominant **g** represents: Recessive

15) The diagram underneath is meant to represent a pair of homologous chromosomes, the different segments represents different genes:



- a) What are the different forms of a gene called? Allele
- b) For which genes is the organism a Heterozygote? B, E, G.

16) Circle either True or False for each statement: *(these are a bit harder....think !)*

- T or F a) Dominant alleles always express themselves when part of the genotype.
- T or F b) To correctly construct a punnet square we must only know the phenotype of the parents.
- T or F c) It is possible to pass to our offspring alleles that are not visible in our phenotype.
- T or F d) The cross between two pure-breed parents will give us a homozygote. *-Not Always.*

17) You mate 2 small dogs and witness that their offspring is a large dog.
 For this particular breed of dog, Small-size(S) is dominant over Large-size(s).
 Why it's possible that these 2 small dogs can produce an offspring that is large.
 Explain your answer and justify using a punnet square.

Both dogs have a recessive large-size allele. Only expresses itself 25% of the time.

| | | |
|---|-------------|--------------|
| | S | s |
| S | SS small | Ss small |
| s | Ss small | ss Large. |

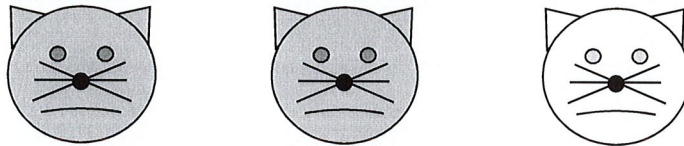
18) A certain vegetable has an allele for yellow color, as well as an allele for orange color. If the vegetable is orange then:

- a) Is the vegetable homozygote or heterozygote for color? Heterozygote.
 b) Which allele is dominant? Orange
 c) Which allele is recessive? Yellow
 d) Give the genotype for this vegetable. Oo

19) Is it possible for 2 individuals to exhibit the same Phenotype yet have different Genotypes? Explain

Yes, doesn't matter if you have 2 of the same dominant genes (ex: EE) or only 1 dominant gene (Ee), the trait will express itself. EE and Ee ← same phenotype diff genotype.

20) For tigers, fur color can take on 2 colors: Reddish and White. The dominant allele for fur color is Reddish, the recessive allele is White. Fill in the table below:



| | | | |
|-------------------|-------------------|---------------------------|--------------------------|
| <u>Phenotype:</u> | Reddish | <u>Reddish</u> | <u>White</u> |
| <u>Genotype:</u> | <u>Homo</u> RR | Heterozygote <u>Rr</u> | <u>Homo</u> <u>rr</u> |

21) Character traits such as eye colour are inherited from our parents. Brown eye colour, B, is dominant over blue eye colour, b.

Tom has brown eyes. He has two children with Karen who has blue eyes. They have a boy with blue eyes and a girl with brown eyes.

What are the genotypes for each member of this family? *Complete the table below.*

| Family Member | Genotype |
|----------------------|-----------|
| Tom with brown eyes | <u>Bb</u> |
| Karen with blue eyes | <u>bb</u> |
| Boy with blue eyes | <u>bb</u> |
| Girl with brown eyes | <u>Bb</u> |

22) The table below provides genetic information on three guinea pigs.

| | Description | Genotype |
|---------------|--------------------------------------|----------|
| Guinea Pig #1 | Has black coloured fur and dark eyes | BbDD |
| Guinea Pig #2 | Has black coloured fur and red eyes | BBdd |
| Guinea Pig #3 | Has white fur and dark eyes | bbDd |

- a) Which guinea pig is heterozygous for black fur? # 1
- b) Which guinea pig is homozygous for red eyes? # 2
- c) What is the dominant allele for fur colour? B (Black)
- d) What is the recessive allele for eye colour? d (Red)

23) A hospital patient who is suffering from liver failure is in desperate need of an organ transplant. What would be an advantage to producing a cloned liver from the patient's own cells?

- Body would not reject "transplant"

24) Farmer A has a field full of a cloned corn plants, all of which have been grown from the same individual. The neighbouring Farmer B also has a field full of corn, however his plants are not cloned.

a) Why might Farmer A have decided to grow cloned corn plants: _____

- Bigger corn (clone) , - Greater Harvest amounts,
- Tastier corn (clone)

b) If a disease strikes both fields, will the consequences be the same for the two corn fields? Explain?

- No if disease only affect the cloned type Farmer A
will have nothing to rely on. If disease only affects
1 type of corn from Farm B, farmer B will still have
some other varieties that won't be affected - Greater Diversity on
farm B.

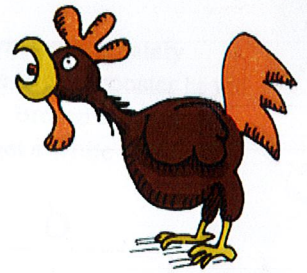
25) Your friend David wants to breed chickens. He prefers Brown chickens over white chickens.

David learned that Brown color is dominant, and white color is recessive.

Unfortunately David doesn't know much else about genetics. He figures that if he simply mates a white chicken with a brown rooster he will get his desired outcome (brown).

David's white chicken has the genotype (bb), while his and rooster has the genotype (Bb)

Using a punnet square show David why he might sometimes get a white chicken even though brown colour is dominant !



$$\frac{2}{4} = 50\%$$

| | | |
|---|-------------|-------------|
| | B | b |
| b | Bb Brown | bb white |
| b | Bb Brown | bb white |

On this planet: Square eyes are Dominant (S) & Round eyes are Recessive (s)
Purple hair is Dominant (P) & Green hair is Recessive (p)

Assuming the laws of genetics are similar for the aliens, If both parents have Genotypes: **SsPp**

Using a Punnet Square, determine the probability of these 2 aliens having a baby alien that has Round eyes and Green Hair ? → **sspp**

| | Alien 1 | Alien 2 |
|-------------------|--------------------------|--------------------------|
| Phenotype: | Square eyes, Purple Hair | Square eyes, Purple Hair |
| Genotype: | SsPp | SsPp |
| Gametes possible: | SP Sp sP sp | SP Sp sP sp |

| | | | | |
|----|------|------|------|-------------|
| | SP | Sp | sP | sp |
| SP | SSPP | SSPp | SsPP | SsPp |
| Sp | SSPp | SSpp | SsPp | Sspp |
| sP | SsPP | SsPp | ssPP | ssPp |
| sp | SsPp | Sspp | ssPp | sspp |

$$\frac{1}{16} \text{ times} = \underline{\underline{6.25\%}}$$



- 27) There are many inherited characteristics found in humans. A genetically determined characteristic or condition is called a trait.

One trait involves ear wax. Wet ear wax is dominant to dry ear wax. Another is eyelash length. Long eyelashes are dominant to short eyelashes.

Lily has dry ear wax and long eyelashes. She has four children with Massimo, who has wet ear wax and long eyelashes.

Lily is heterozygous for long eyelashes. Massimo is heterozygous for long eyelashes, and he is homozygous for wet ear wax.

W = Wet ear wax
w = Dry ear wax
L = Long Eyelashes
l = Short Eyelashes.

- a) What is the genotype of each parent

Lily (female): wwLl

Massimo (male): WWLl

- b) Construct a punnet square to show all the possible phenotypes and genotypes that Lily and Massimo can produce.

Lily
wL wL
wL wL

Massimo
WL Wl
WL Wl

| | wL | wL | wl | wl |
|----|-------------------------|-------------------------|--------------------------|--------------------------|
| wL | WwLL Wet E Long E | WwLL Wet E Long E | WwLl Wet E Long E | WwLl Wet E Long E |
| wL | WwLL Wet E Long E | WwLL Wet E Long E | WwLl Wet E Long E | WwLl Wet E Long E |
| wl | WwLl Wet E Long E | WwLl Wet E Long E | Wwll Wet E Short E | Wwll Wet E Short E |
| wl | WwLl Wet E Long E | WwLl Wet E Long E | Wwll Wet E Short E | Wwll Wet E Short E |

- c) Using your punnet square determine the following probabilities:

Wet ear wax with Long eyelashes: $\frac{12}{16} = 75\%$

Wet ear wax with Short eyelashes: $\frac{4}{16} = 25\%$

Dry ear wax with Long eyelashes: 0%

Dry ear wax with Short eyelashes: 0%

28) Place a check mark in the appropriate box involving cloning.

ex:

| | | | | |
|--|---|--|--|--|
| | ✓ | | | |
|--|---|--|--|--|

| | | | | |
|-----------------|----------------------------|-----------------------------|---------------------|-------------------|
| Natural Cloning | Artificial (Plant) Cloning | Artificial (Animal) Cloning | Therapeutic Cloning | Molecular Cloning |
|-----------------|----------------------------|-----------------------------|---------------------|-------------------|

a) Sea sponges can reproduce by budding process. Living cells are released from parents and becoming new individuals

| | | | | |
|---|--|--|--|--|
| ✓ | | | | |
|---|--|--|--|--|

b) Dolly the sheep was the first mammal to be grown from cells removed from an individual

| | | | | |
|--|--|---|--|--|
| | | ✓ | | |
|--|--|---|--|--|

c) Wild raspberries plants have begun growing everywhere on Susan's lawn after she planted just one plant

| | | | | |
|---|--|--|--|--|
| ✓ | | | | |
|---|--|--|--|--|

d) Scientist are trying to produce individual cows that are identical to a specific cow that can generate large volumes of milk.

| | | | | |
|--|--|---|--|--|
| | | ✓ | | |
|--|--|---|--|--|

e) Specific human genes are grown and copied on yeast cultures in order to study them further in hopes of curing certain diseases

| | | | | |
|--|--|--|--|---|
| | | | | ✓ |
|--|--|--|--|---|

f) Studies are underway in many laboratories to create organs for people in need of transplants. These organs would be grown from individual cells from that person.

| | | | | |
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g) Frozen Woolly Mammoth tissue is being studied in some laboratories. It is believed that the extracted DNA can be used to bring back into existence this extinct animal, using a surrogate living animal (elephant).

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|--|--|---|--|--|
| | | ✓ | | |
|--|--|---|--|--|

h) Many hospitals use skin grafts to help burn victims. Skin is initially taken from an individual and it is grown in a lab in order to acquire larger amounts

| | | | | |
|--|--|--|---|--|
| | | | ✓ | |
|--|--|--|---|--|

i) The specific genes (BRCA1 and BRCA2) that cause hereditary breast cancer have been isolated and reproduced in a lab. This will help researchers in their studies to find a cure.

| | | | | |
|--|--|--|--|---|
| | | | | ✓ |
|--|--|--|--|---|

j) Human cloning is illegal in Canada and the USA.

| | | | | |
|--|--|---|--|--|
| | | ✓ | | |
|--|--|---|--|--|

k) Children cut leaves from a plant and then place them inside a pot where they begin to grow by themselves.

| | | | | |
|---|--|--|--|--|
| ✓ | | | | |
|---|--|--|--|--|