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01. Inheritance

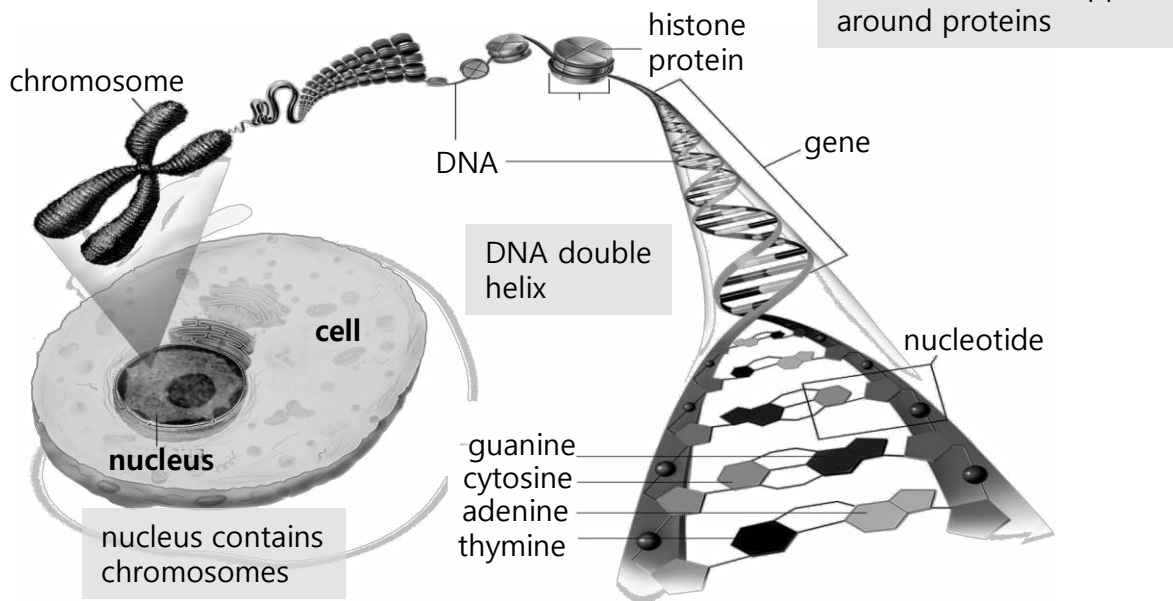
① Definition

inheritance is the transmission of genetic information from generation to generation

② Chromosomes, Genes and Proteins

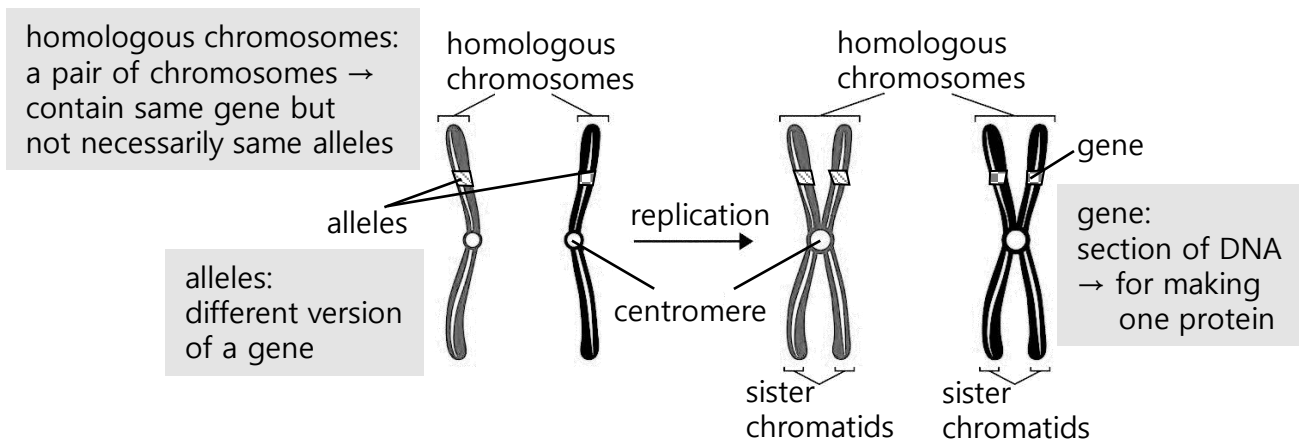
a definition

- i. chromosome → thread of DNA, made up of a string of genes
- ii. gene → length of DNA → codes for a protein



b structural feature

- i. chromosomes are located in nucleus of cells
 - thread-like structures of DNA, carrying genetic information in the form of genes
- ii. gene
 - short length of DNA found on a chromosome → codes for a specific protein
 - control our characteristics as they code for proteins
- iii. allele
 - different versions of a particular gene



Fill in the Blanks

01. Inheritance

① Definition

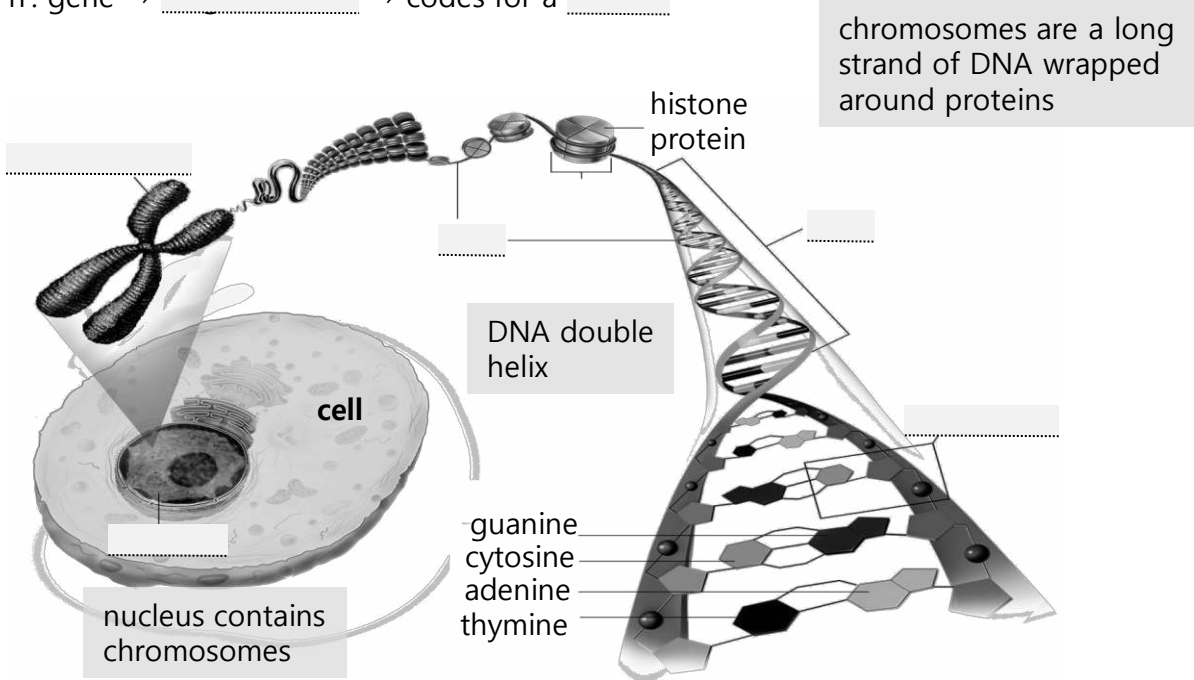
inheritance is the _____ from generation to generation

② Chromosomes, Genes and Proteins

a) definition

i. chromosome → _____, made up of a string of genes

ii. gene → _____ → codes for a _____

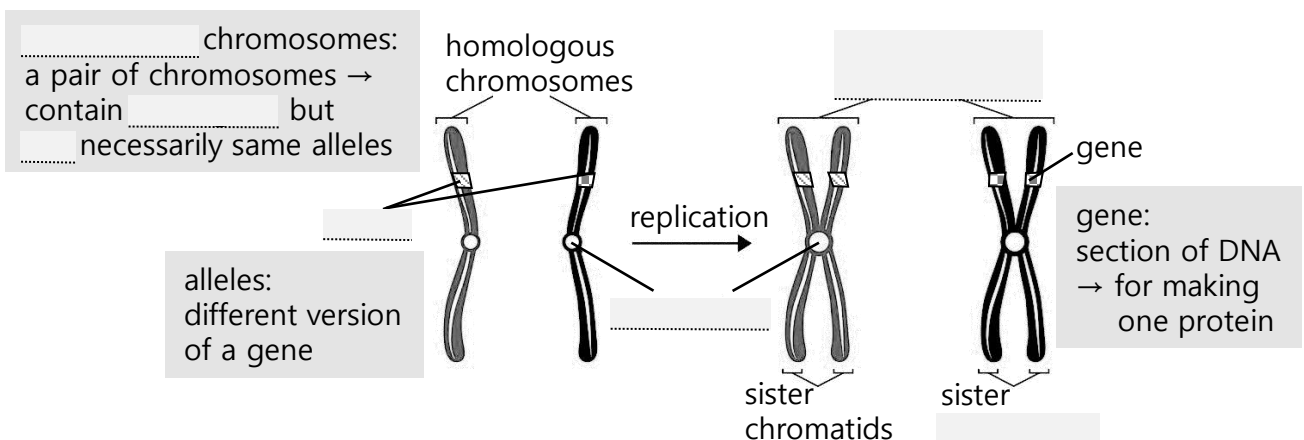


b) structural feature

i. chromosomes are located in _____ of cells
→ thread-like structures of DNA, carrying _____ in the form of genes

ii. gene
short _____ found on a chromosome → _____ for a specific protein
→ control our characteristics as they code for proteins

iii. _____
→ different _____ of a particular gene



MEMO

004.

Owners of successful shepherd dog want that the dog's offspring will be like their parents.

How does a young shepherd dog inherit that characteristics?

- A passed across the placenta
- B mainly from the dog's mother
- C mainly from the dog's father
- D equally from the dog's mother and father

005.

What is genetics researching?

- A cell division
- B mechanisms of inheritance
- C variation between species
- D development of organisms

006.

Which one is **not** affected by the environment?

- A health
- B height
- C blood type
- D body weight

023.

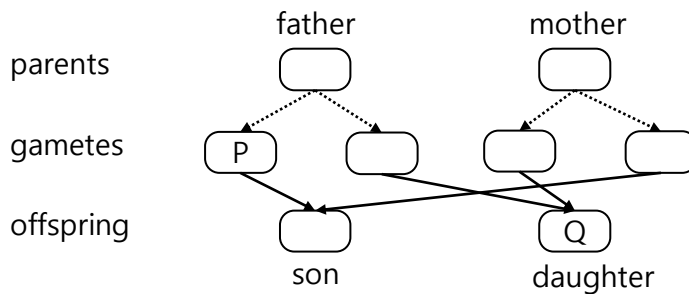
MEMO

Which statement about the human sex chromosomes is correct?

- A** Males have two X chromosomes.
- B** Females have two Y chromosomes.
- C** Males and females have at least one X chromosome.
- D** Males and females have at least one Y chromosome.

024.

The diagram shows the fusion in which gametes produce a daughter and a son.



What are the sex chromosomes in gamete **P** and son **Q**?

	P	Q
A	X	XX
B	Y	XX
C	X	XY
D	Y	XY

025.

A woman has three sons.

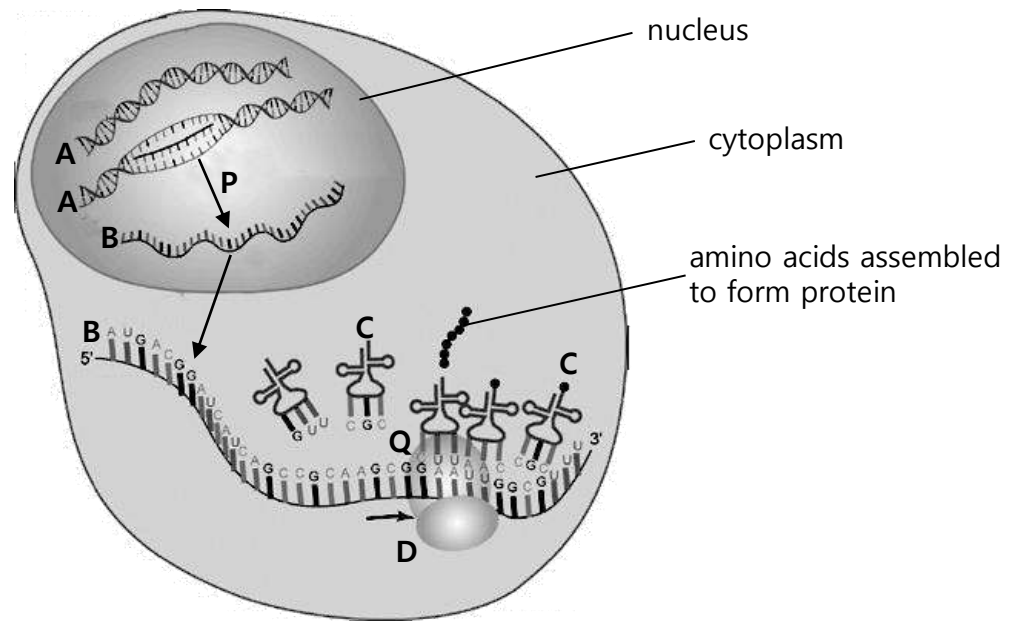
What is the chance of her next child being a daughter?

- A** 0%
- B** 25%
- C** 50%
- D** 75%

MEMO

032.

The figure below shows how a protein is made in a human body cell.



① State the name of molecule **A**, **B**, **C** and structure **D**.

A.

B.

C.

D.

① State the name of process **P** and **Q**.

P.

Q.

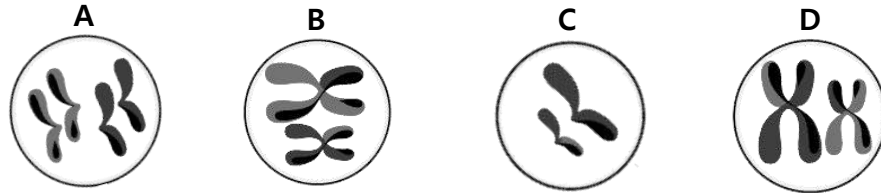
MEMO

051.

The figure is the chromosomes of four daughter cells produced by meiosis.



Which parent cell produced these cells?



052.

What explains the cells of a sperm, egg and the cells of the embryo in a human lifetime?

	sperms	eggs	the cells of the embryo
A	diploid	haploid	diploid
B	diploid	diploid	haploid
C	haploid	diploid	haploid
D	haploid	haploid	diploid

053.

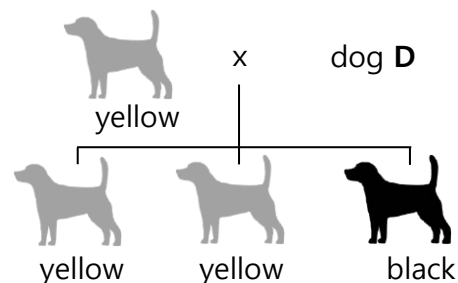
Which statement about meiosis is correct?

- A** During meiosis the haploid number is halved in the daughter cells.
- B** Meiosis is reduction division in which diploid daughter cells are produced.
- C** Parent cell contains twice as many chromosomes as each daughter cell.
- D** At the end of meiosis a zygote has been produced.

MEMO

089.

The diagram right shows the offspring of a cross between two dogs. Yellow colour is caused by a dominant allele Y and black colour by a recessive allele y.

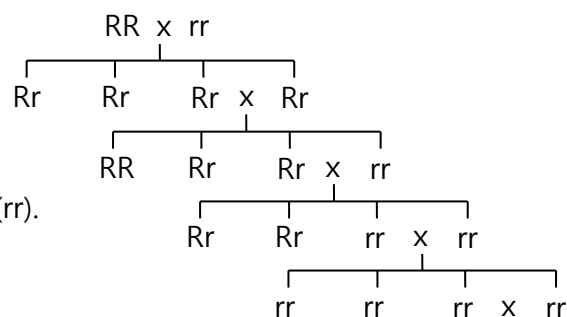


What are the phenotype and the genotype of dog **D**?

	phenotype	genotype
A	Y	Yellow
B	yy	Black
C	Yellow	Yy
D	Black	y

090.

The genetic diagram right shows a breeding experiment starting with crossing a homozygous red flower plant (RR) with a homozygous white flower plant (rr).



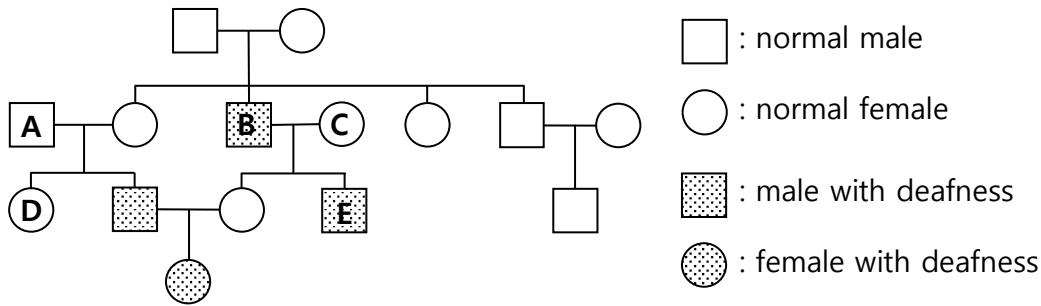
Which genetic cross gives 1 : 1 phenotypic and genotypic ratios?

- A** Rr x rr **B** RR x rr **C** rr x rr **D** Rr x Rr

097.

MEMO

A scientist was asked to investigate the inheritance of deafness in cats. The normal allele is represented by **D** and the mutant allele is represented by **d**. The scientist made the pedigree in the below to show the inheritance of deafness in a family of cats. The shaded symbols indicate the dogs with deafness.



① State the genotypes of the cats identified as A, B and B.

A

B

C

② The scientist crossed cat D with cat E. Half of the offspring had deafness and half the offspring did not have deafness. Complete the genetic diagram to show how this is possible.

③ State the name given to the type of cross that you have completed in ②.

.....

099.

MEMO

The allele, R, codes for an enzyme that produces normal starch grains and this results in seeds that are round.

The allele r does not code for an enzyme, so starch grains are not formed normally and this results in wrinkled seeds.



round pea seed



wrinkled pea seed

Pure bred plants are homozygous for the genes involved. A plant breeder had some pure bred pea plants grown from round seeds and some pure bred pea plants grown from wrinkled seeds.

- ① Describe the genotype of pure bred plants grown from round seeds and wrinkled seeds.

round

wrinkled

- ② These pure bred plants were cross pollinated (cross **1**) and seeds were collected and all the seeds were round. These round seeds germinate and grow into adult plants (offspring **1**) and self-pollination (cross **2**). The pods of the offspring 1 plants contained both round and wrinkled seeds. Additional cross (**3** and **4**) were carried out as shown in the table below.

Complete the table below:

cross		phenotype of seeds		ratio of round to wrinkled seeds
		round seeds	wrinkled seeds	
1	pure bred for round seeds x pure bred for wrinkled seeds	O	X	1:0
2	offspring 1 self-pollinated			
3	offspring 1 x pure bred for round seeds			
4	offspring 1 x pure bred for wrinkled seeds			

MEMO

100.

A variety of moth, *Biston betularia*, has white speckled wings. In contrast, the second variety of the same species has black wings. There is no intermediate form. And the table below shows the phenotype and genotype of the two different varieties of this species.



phenotype	genotype
white and speckled wing	HH and Hh
black wing	hh

- ① Describe and explain which wing color is dominant.

dominant wing colour

explanation

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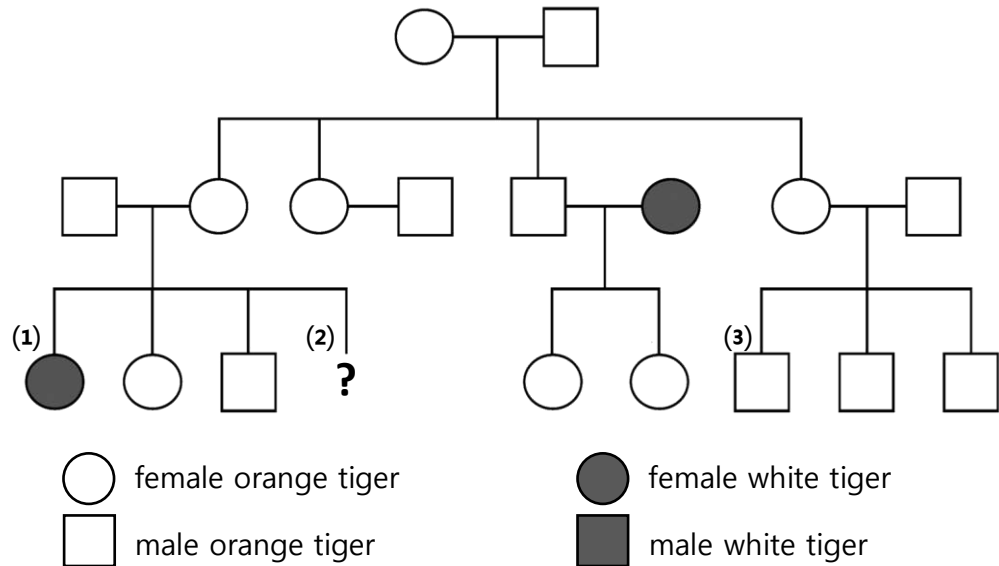
- ② The heterozygous moths were interbred.
Predict the proportion of black-winged moths present in the next generation using the genetic diagram.

proportion of black winged moths

MEMO

104.

The figure shows a pedigree diagram of a population of tigers.



- ① Deduce the genotype of tiger (1).

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- ② Predict the probability of cheetah (2) being a white tiger.

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- ③ Describe how a breeder could determine the genotype of tiger (3).

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- ④ When the white tiger was first discovered it was thought that it was a new species. Pedigree diagrams of cheetahs proved it was not a new species.

Suggest one type of evidence, other than pedigree diagrams, that can be used to determine how closely related organisms are.

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113.

The carnation plant, *Dianthus caryophyllus*, can have three colors of flowers as shown in the figure right.



- ① A geneticist crossed a red-flowered plant with a white-flowered plant (cross 1). He collected seeds and grew them, and every plant that grew from these seeds had pink flowers. Complete the genetic diagram to describe the result of cross 1.

parental phenotypes red flower x white flower

parental genotypes RR x rr

gametes   +  

offspring phenotypes

offspring genotypes

- ② Then he experimented with three further crosses as shown in table below. Complete the table by writing the genotypes of offspring of crosses A, B, and C using the same symbols as in the diagram above.

cross		genotype of offspring
A	offspring of cross 1 × offspring of cross 1	
B	offspring of cross 1 × white-flowered plant	
C	offspring of cross 1 × red-flowered plant	

- ③ Carnation flower color is not an example of inheritance of dominant and recessive alleles. Describe how the results of the cross show that these alleles for flower color are not dominant or recessive.

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MEMO

115.

MEMO

Discuss whether the sickle cell trait is an example of co-dominance.

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116.

Two sisters must make a difficult decision. A sister with blood group AB has kidney failure and is on dialysis. A healthy sister has agreed to donate one of her kidneys to her sister.

She should have a blood test. Their father is blood type B, and their mother is type A. The sisters has a younger brother, blood type O.

- ① Using a genetic diagram, describe how this boy's blood type is O when his parents have different blood types.
(I^A , I^B and I^O to represent the alleles of blood types)

parental phenotypes blood type B x blood type A

parental genotypes x

gametes   +  

boy's genotypes

boy's phenotypes

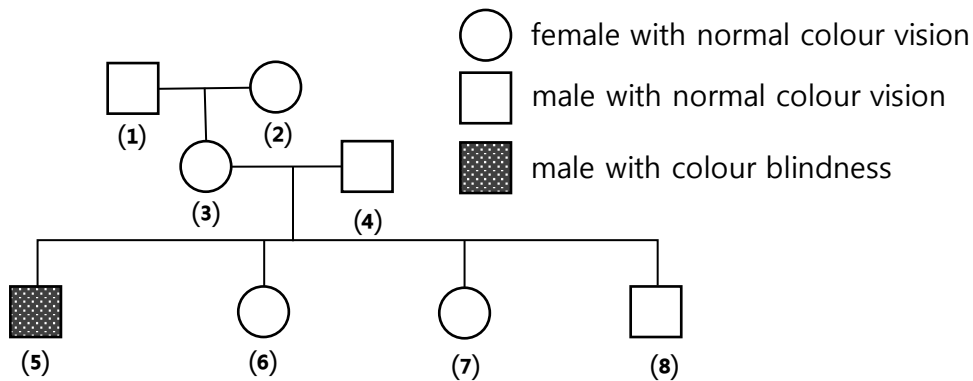
- ② The healthy sister can donate the kidney only to her sister of the same blood type.
What is the probability that the healthy sister also has AB blood type?

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119.

MEMO

Colour blindness is a characteristic that is inherited. The figure below is a pedigree diagram showing the inheritance of colour blindness in a family.



- ① Using the symbols **B** and **b**, state the genotypes of individual (5) and individual (8) in the pedigree diagram.

(5). (8).

- ② Individual (3) is a carrier of colour blindness because she has one copy of the allele for colour blindness but has normal colour vision. Describe evidence from figure that shows that individual (3) is a carrier.

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- ③ There was no history of colour blindness in the parents and grandparents of individuals (1) and (2). Suggest how colour blindness first occurred in the family in the figure.

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01. Inheritance

001.	C	002.	D	003.	D	004.	D	005.	B
006.	C	007.	D	008.	B	009.	A		

010. Answer

The correct answer should include the following words and phrases:

- transmission of genetic information from generation to generation

011. Answer

The correct answer should include the following words and phrases:

- (1) haploid
- (2) gene
- (3) phenotype
- (4) mitosis

012. Answer

The correct answer should include the following words and phrases:

- if it is present the allele that is
 - expressed or
 - always seen in the phenotype

013. Answer

definition	name
having one set of chromosomes	haploid
the outward appearance of an organism	phenotype
a length of DNA that codes for a protein	gene
type of nuclear division which gives daughter nuclei that are genetically identical	mitosis

02. Inheritance of Sex



						014.	D	015.	C
016.	C	017.	A	018.	D	019.	D	020.	B
021.	C	022.	B	023.	C	024.	B	025.	C

026. Answer

male wolf (XY)

female wolf (XX)	gametes	X	Y
	X	XX	XY
	X	XX	XY

- 1:1 or 50:50 or 50% male 50% female



03. Gene Expression: Protein Synthesis

		027.	D	028.	A	029.	D		
--	--	------	---	------	---	------	---	--	--

030. Answer

The correct answer should include the following words and phrases:

- gene
 - a length of DNA that codes for a protein
- gene mutation
 - a change in base sequence of DNA

031. Answer

- DNA (or gene) remains in the nucleus
- mRNA is a copy of the DNA (or gene)
- mRNA passes through nucleus membrane and attaches to ribosome
- mRNA base sequence determines sequence of amino acids in proteins

136.

MEMO

Researchers published the results of an investigation into the DNA of dogs with and without polydactyly. They compared the base sequence from a particular region of DNA that controls the development of the limbs. The table below shows the base sequences.

dog type	DNA sequence
Kay's dogs without polydactyly	GAT TCT TCT TTA CTC
Kay's dogs with polydactyly	GAT TCT AAT TTA CTC
dogs with polydactyly from S. Korea	GAT TCT AAT TTA CTC
dogs with polydactyly from UK	GAT TCT TCA TTA CTC

- ① Describe how the base sequences of the dog with polydactyly differ from the base sequence of cats without polydactyly.

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- ② State the name of the process by which base sequences in DNA are changed.

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- ③ The base sequences in the table provide evidence that indicates which country the Kay's dog came from. Suggest which country the dog came from and give a reason for your choice.

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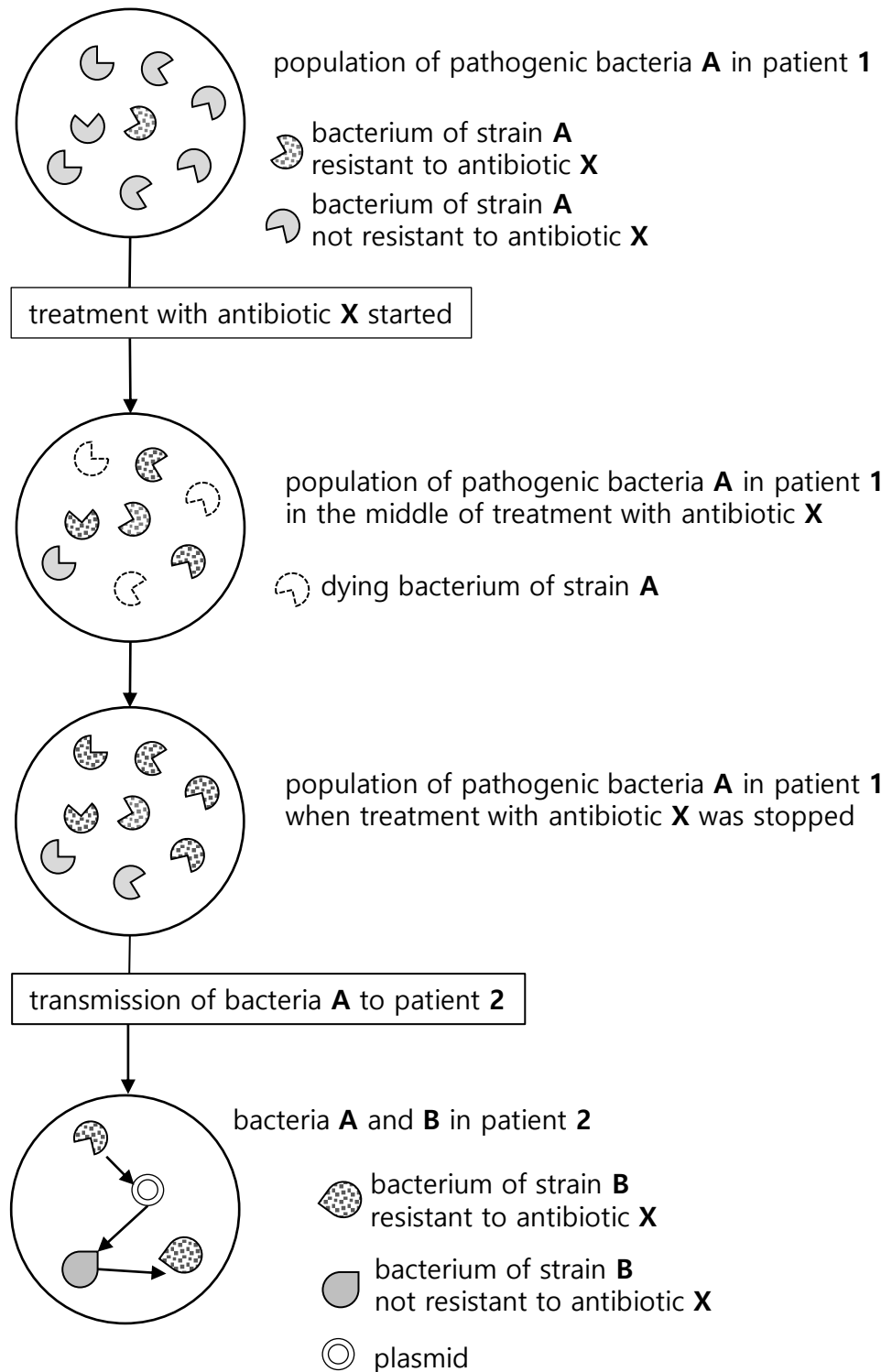
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MEMO

148.

The figure below shows how a population of bacteria may develop antibiotic resistance and how the antibiotic resistance can be passed from one strain of bacterium to another.

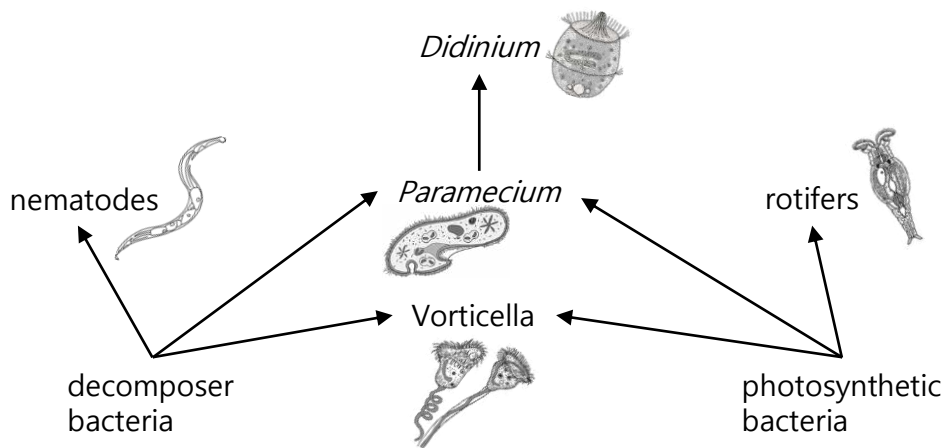


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181.

MEMO

The figure below is a food web for some of the microorganisms in a sewage treatment works.



- ① Construct one food chain with three trophic levels that use energy derived from the breakdown of sewage.
(Do not draw the organisms.)

.....

- ② The water that passed out of the sewage works was often cloudy with suspended matter. Researchers discovered that ciliates reduce the cloudiness of water during sewage treatment.

Suggest how the ciliates reduce the cloudiness of the water using the information in the figure above.

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MEMO

207.

The elk (*Cervus canadensis*) shown in the figure right is a large herbivores that lives mainly in North America and East Asia. They have a varied diet that includes grasses and leaves.



Vancouver island is a large island in Canada that has a population of elks that has long been studied by ecologists.

The only predator of the animal is the black bear. The island also has a population of black bears that have changed in number over the years.

- ① Based on the information shown in the passages above, draw the food chain for the organisms.

- ② Complete the table below by identifying the name and trophic level of each organism in the food chain.

name of organism	trophic level

- ③ State three factors that affect the number of top predators, such as black bears.

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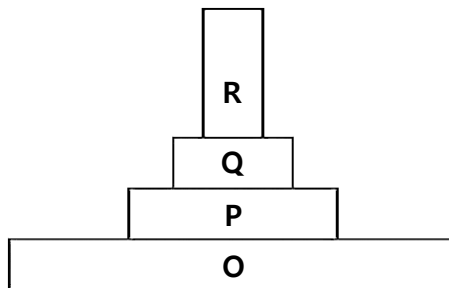
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MEMO

210.

The diagram shows a pyramid of biomass for all organisms in an ecosystem.



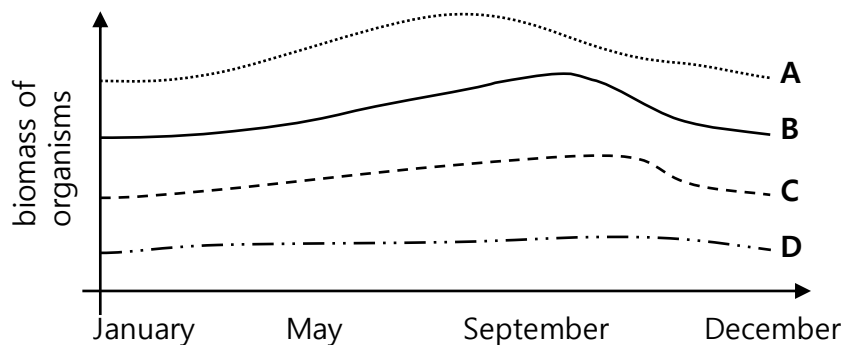
Which organisms are herbivores?

- A** only O **B** only P **C** Q and R **D** P, Q and R

211.

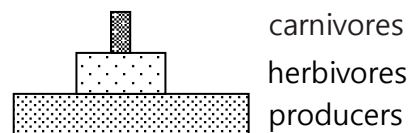
The graph shows changes in biomass of different organisms in an ecosystem over a year period. Each line represents a different trophic level.

Which line represents the herbivores?

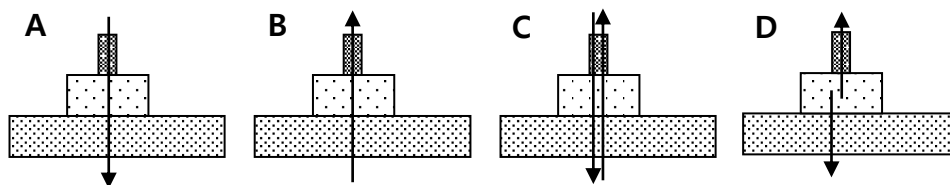


212.

The diagram right shows a pyramid of biomass within an ecosystem.



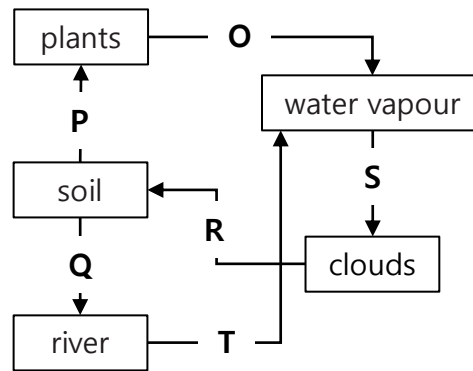
What indicates the direction of energy flow through the pyramid?



263.

The diagram right shows part of the water cycle.

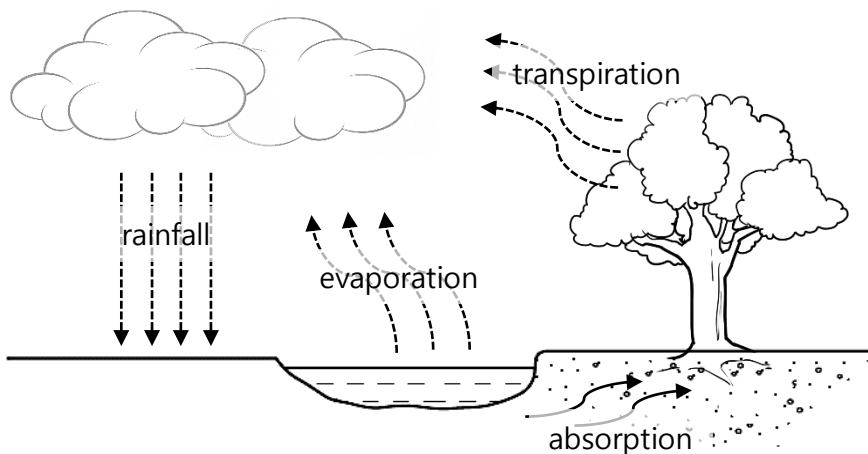
Which arrows show evaporation, condensation, precipitation and transpiration?



	evaporation	condensation	precipitation	transpiration
A	O	R	P	Q
B	S	Q	O	T
C	T	S	R	O
D	P	R	P	O

264.

The diagram below shows part of the water cycle.



What processes slow down when humidity increases?

- A** rainfall and absorption
- B** rainfall and evaporation
- C** absorption and transpiration
- D** evaporation and transpiration

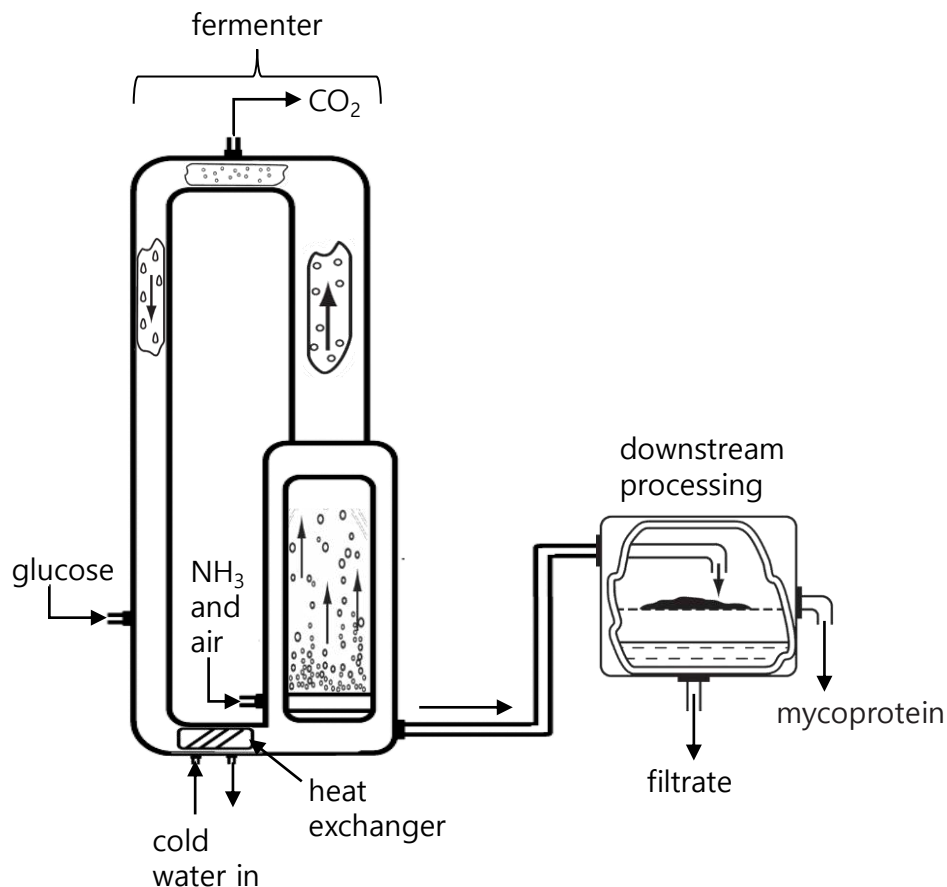
MEMO

MEMO

304.

Mycoprotein is a type of protein that comes from a fungus, *Fusarium venenatum*. Mycoprotein is a popular ingredient in meat alternative products.

The production process for mycoprotein is shown in the figure below.



- ① Describe why ammonia (NH_3) and air are pumped into the fermenter.

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continue to the next page ...

MEMO

308.

A gene for insulin is taken from a human cell and placed in a bacterial plasmid. The bacterium can then make human insulin. What is this process called?

- A** natural selection
- B** artificial selection
- C** genetic engineering
- D** heterozygous inheritance

309.

What term is used for the transference of a gene from one organism to another?

- A** mutation
- B** artificial selection
- C** genetic engineering
- D** genetic selection

310.

Some crop plant has been genetically modified to make it resistant to herbicides. Which is a possible disadvantage of introducing this new crop plant?

- A** The crop plant is unharmed and produces a higher yield.
- B** The new gene will appear in new generations of the crop.
- C** Some weeds might become resistant to the herbicide.
- D** Loss of weeds reduces competition.

MEMO

329.

In many parts of the world dairy cattle are kept in large barns and reared intensively, as shown in the figure below.



- ① Ecologists have calculated that it is more energy efficient to grow crops for human consumption than for food for livestock. Explain why intensive rearing of livestock is not an efficient use of crops.

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- ② Intensive livestock production could be one way of preventing famine. Describe the causes of famine.

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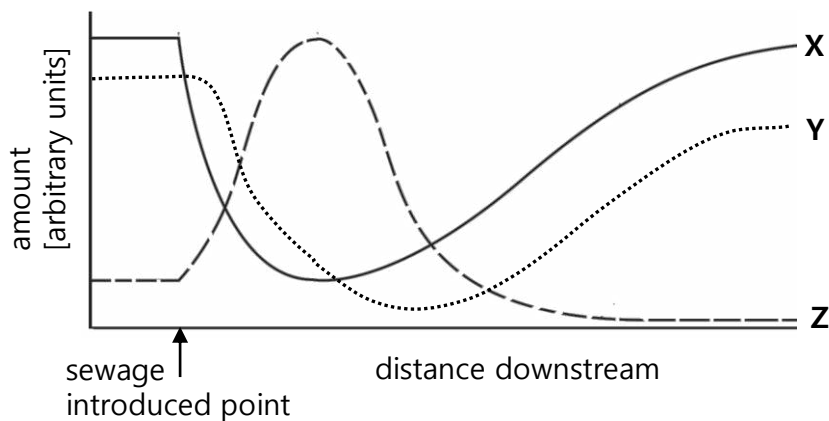
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MEMO

369.

The graph shows how the concentration of dissolved oxygen and the numbers of fish and bacteria in a river change when sewage flows into it.



What are **X**, **Y** and **Z**?

	X	Y	Z
A	fish	bacteria	oxygen
B	fish	oxygen	bacteria
C	oxygen	fish	bacteria
D	oxygen	bacteria	fish

370.

A persistent pesticide is one that does not break down. What is one disadvantage of a persistent pesticide?

- A** It dissolves in water.
- B** It breaks down within a few weeks.
- C** It only destroys one particular pest in the food chain or food web.
- D** It becomes more concentrated at each level in the food chain or food web.

01. Food Supply

								320.	A
321.	B	322.	C	323.	D	324.	B	325.	A

326. Answer

The correct answer should include the following words and phrases:

- ①
 - **A** has lost the most forest compared with in **B**
 - **A** forest has continued to be lost whereas loss in **B** has slowed between 2010 and 2015
- ②
 - planted forest has one (dominant) species
 - is a monoculture
 - loss of biodiversity
 - (plantation) susceptible to pest
 - disease
 - nutrients removed
 - soils become infertile ;

327. Answer

The correct answer should include the following words and phrases:

- provide mineral for plant nutrients
 - that are in low concentration in soils
- minerals are limiting factor for growth and yield
 - magnesium ions for chlorophyll production for photosynthesis
- nitrogen or nitrate ions
 - for making amino acids or proteins

328. Answer

The correct answer should include the following words and phrases:

- deforestation
 - loss in variety of habitat
- disruption to food chains
 - loss of biodiversity
 - extinction of species
 - species become endangered
- soil erosion
 - increased risk of landslides and flooding ;
- disrupted nutrient cycling
- decrease in soil water
 - desertification
- spreading, of crop diseases or pests
- overuse of herbicides, pesticides, insecticides
 - killing of non-target species
- pollution of waterways by fertiliser
- pollution of the atmosphere by NO_x from fertilisers
- pollution by use of fossil fuels in machinery

329. Answer

The correct answer should include the following words and phrases:

- ①
 - if crops are used as food for humans fewer trophic levels in the food chain
 - energy lost at each trophic level in the food chain
 - 90% energy lost / only 10% energy passed on
 - energy is lost from the cattle
 - any two examples of energy loss from cattle
 - therefore less energy available to humans
- ②
 - lack of food supply
 - unequal distribution of food
 - wars or sudden immigration with inadequate resources for the population
 - drought or floods
 - destroy crops or kill livestock
 - disease in food plants or animal

330. Answer

The correct answer should include the following words and phrases:

- number of leaves increases for both group
- group A grew more leaves
- number of leaves increases more rapidly in group A



02. Habitat Destruction

331.	B	332.	C	333.	B	334.	C	335.	C
336.	C	337.	B						

338. **Answer**

The correct answer should include the following words and phrases:

- roots die so do not bind the soil
 - loss of soil
 - soil erosion
 - reduced soil fertility
- no trees to absorb the water
 - increased risk of flooding
- increased rate of evaporation
 - land is exposed to drying
 - desertification (decreased soil water)
- loss of habitat
 - disruption to food chain
 - endangered or extinction of species
 - loss of biodiversity

339. **Answer**

- increase in water
 - flooding
 - waterlogging
- decrease in water
 - desertification ;
- soil erosion
- loss of, habitat
 - disruption to food chain
 - endangered, extinction of species
 - loss of biodiversity

340. **Answer**

- collecting or sorting of paper
 - shredding
- adding water to make pulp
 - paste
 - cleaned
 - de-inked
- bleached
- rinsed
- pressed, rolled, flattened and dried into sheet

341. **Answer**

- paper manufacture
- firewood
- clearance for
 - agriculture (or urbanisation, roads, housing)
- extraction of minerals (or other natural resources)

342. **Answer**

The correct answer should include the following words and phrases:

- ①
 - deforestation
- ②
 - increased area needed for plant crop production
 - increased area needed for livestock production
 - housing
 - urbanisation
 - extraction of natural resources

03. Pollution

				343.	B	344.	D	345.	A
346.	B	347.	C	348.	D	349.	A	350.	D
351.	C	352.	B	353.	C	354.	A	355.	D
356.	C	357.	A	358.	D	359.	B	360.	C
361.	B	362.	C	363.	A	364.	B	365.	B
366.	C	367.	A	368.	D	369.	C	370.	D
371.	B	372.	B	373.	D				

374. **Answer**

The correct answer should include the following words and phrases:

- methane
- carbon dioxide

375. **Answer**

- (1) factories (or industries, mining)
 - exhaust from
- (2) fertiliser (or detergents, sewage)
- (3) combustion of coal (or oil)
- (4) nuclear fall-out (or radioactive waste)
- (5) mutations (or changes genes)