Az írásbeli vizsga időtartama: 120 perc

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NÉMZETI ERŐFORRÁS MINISZTÉRIUM
Important information

Before you start working read this information carefully

You have 120 minutes to complete your intermediate level examination. Your questions are either multiple choice or open-ended ones.

**When answering multiple choice questions** you need to write one or two CAPITAL LETTERS into the empty boxes. These are the letters of the correct answer or answers. Make sure that your answers are clear, otherwise they will not be accepted. If you want to correct your answer CROSS OUT the wrong one and WRITE the correct letter NEXT TO IT!

![Correct and Incorrect Examples]

**When answering open-ended questions**, you need to write technical terms, a few words, a whole sentence or several sentences. Write your answers on the dotted (…….) line. MIND YOUR GRAMMAR because if your answer is not understandable because of bad grammar, or because it is illegible (e.g. it is not clear what the subject of the sentence is), it will not be acceptable even if it contains the correct terms

**Use black or blue pen**

Don’t write anything into the grey boxes.

Good luck for your exam.
I. Insects and Fish  

9 points

Compare the anatomical features and life processes of insects and (bony) fish. Write the letter of the correct answer into the box next to each statement. 1 point is given for each correct answer.

A. True for insects  
B. True for fish  
C. True for both  
D. True for neither

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<td>1.</td>
<td>They require oxygen for their life processes.</td>
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<td>2.</td>
<td>They are able to obtain the oxygen they need by splitting water.</td>
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<td>3.</td>
<td>Tissue level of organisation is typical of them.</td>
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<td>4.</td>
<td>Generally they have external fertilisation.</td>
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<td>5.</td>
<td>The oxygen is carried to the cells by the circulatory system.</td>
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<td>6.</td>
<td>They have compound eyes.</td>
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<td>7.</td>
<td>Their muscles are attached to the skeletal elements from the inside of the body.</td>
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<td>8.</td>
<td>They have constant (internally regulated) body temperature.</td>
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<td>9.</td>
<td>They are eukaryotic organisms.</td>
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Total: ______
II. Dangerous relationships 10 points

Answer the questions about aphids after reading the text below. *1 point is given for each correct answer.*

‘Aphids feed by sucking plant saps… They insert their long and thin sucking mouthparts (stylet) into the vascular bundles of plants to suck out the saps…

This plant sap is very rich in glucose and very poor in nitrogen. However, nitrogen is an important component of the aphids’ diet, therefore they have to suck a lot of sap to obtain enough of it. As a result, the sap collects at the tip of their abdomens slowly in the form of droplets, which still contain a lot of sugar. Although aphids can no longer make use of it, ants can collect the honeydew drops emerging at the tip of the aphids’ abdomen. In doing so, ants promote the reproduction of their aphid herds and even protect them against predators. Hungry ladybird larvae attack caterpillars and other plant eating insects. However, they have little chance for success if the aphid herds are guarded by ants.’

*David Attenborough*

1. Which part of host plant’s vascular bundle do aphids insert their mouthparts (stylet) into?

2. Give your reason for the previous answer by referring to the appropriate part of the text.

3. On which side of the leaves are aphids found most of the time?

4. Give your reason based on the text why aphids are classified as arthropods and more specifically as insects.

5. ‘Nitrogen is an important component of the aphids’ diet.’ the text says.

6. Name the nitrogen containing substance which makes up most of their exoskeleton/outer integument.
Name the type of population interaction which occurs between the following organisms.

6. Aphid – host plant: .................................................................

7. Ant – aphid: ...........................................................................

8. Ladybird – aphid: .................................................................

Biological pest control against aphids relies partly on ladybirds. Name one important characteristic of biological pest control and at least one of its advantages over chemical control.

9. Characteristic: ...........................................................................

10. Advantage: .............................................................................

III. Digestion and absorption 10 points

The following statements are about some of the nutrients in the human diet as well as about their digestion and absorption. Write the number of each statement into the appropriate circle or to the space marked by the overlapping circles. Each number can only be used in one particular space.

1. Starch belongs to this group.
2. Pancreatic enzymes are involved in their digestion.
3. Their digestion starts in the stomach.
4. One of their digestive enzymes is salivary amylase.
5. The end products of their digestion are absorbed into the body fluids (blood and lymph).
6. They are broken down into amino acids in the process of their digestion.
7. The end products of their digestion dissolve well in water.
8. Their digestion is helped by bile.
9. As a result of their digestion small organic molecules are produced.
10. Peptide bonds are broken in the process of their digestion
IV. Peculiar slimming diet 11 points

‘One of the female orang-utans of the Brookfield Zoo has undergone some spectacular changes.

The female called Maggie is one of the oldest orang-utans in the US. It was in 1995 that she got into the Brookfield Zoo in Chicago. Earlier she did not take any notice of her mates and showed no interest in males either in addition to suffering from severe headaches. Furthermore, she put on a lot of weight so that she weighed over a hundred kilograms.

Medical examination revealed that she had problems with her thyroid gland and, as a result, her metabolic rate slowed down and energy levels decreased. Due to the hormone supplementation she was given, her metabolic rate speeded up and, parallel with this, she was put on a diet high in fibre and started an exercise training programme designed for her. The result: 45 kg lost, healthier fur, increased libido. According to her keepers she is showing increased interest in males, sometimes even chasing them around.’

The hormone regulation of an orang-utan is very similar to that of a human
1. Considering all this, name the hormone whose deficiency caused the symptoms of the orang-utan.

2. What are the effects of the hormone in question produced by the thyroid gland. Write the letters of the correct answers into the boxes.

   A. It increases the rate of oxidation processes in the cell.
   B. It decreases the temperature of the body.
   C. It decreases the sugar level of the blood.
   D. It increases heart rate.

3. What other effects does the thyroid hormone in question have?

   A. It increases the temperature of the body.
   B. It stimulates the anabolic processes of carbohydrates.
   C. Through a negative feedback loop, this hormone inhibits the production of a pituitary hormone which, in turn, stimulates the hormone's own production.
   D. It increases the calcium level of the blood.
4. What further effects does the thyroid hormone in question have?

A. It increases the amount of urine.
B. It stimulates catabolic processes.
C. It increases the oxygen consumption of the body.
D. Through a negative feedback loop, this hormone induces the production of a pituitary hormone which, in turn, stimulates the hormone's own production.

5. The figure below shows the location of the human thyroid gland. Name the parts indicated by the letters. (3 points)

A: ........................................
B: ........................................
C: ........................................

Based on the article one could suggest that a thyroid gland extract could be recommended to those on slimming diet.

6. Would you recommend thyroid extract to be administered to those who are overweight but have normal thyroid functions as a possible method to lose weight? (2 points)

                                                                                                           
                                                                                                           
                                                                                                           
                                                                                                           

7. Why was the slimming diet of the orang-utan helped by the diet high in fibre? Can this method be recommended to humans as well? (2 points)

                                                                                                           
                                                                                                           
                                                                                                           
                                                                                                           
                                                                                                           

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V. Birds and Dinosaurs 6 points

After reading the text answer the following questions.

‘Feathers … besides birds, also appeared in certain groups of dinosaurs. The 75 million-year-old specimen of *Velociraptor* which has just been found in Mongolia shows signs of bearing secondary feathers on the backside of its ulna in the form of warts serving as attachment sites for the secondary feathers. These warts also appear in modern birds, …which means that wherever they appear they can be safely associated with modern feathers. …We are not sure of the role these feathers played in Velociraptor which was definitely incapable of flying. They might have been of some help in regulating their body temperature, camouflaging, keeping the nest warm, or making their bodies aerodynamically more favourable.’

Source: Élet és Tudomány LXII. Évf. 43. pp.: 1348-1349

* Aerodynamic = streamlined

1. Dinosaurs – like the *Velociraptor* discussed in the article – were the reptiles of the Mesozoic era. Which of the characteristics listed below are shared by both reptiles and birds? Write the letters of the correct answers into the boxes.

A. Sweat glands
B. Internal fertilisation
C. Reproduction with eggs
D. Air capillaries present in the lungs.
E. Placenta

2. Based on the finding discussed in the article, what characteristics – shared by birds as well – can be expected to have appeared in *Velociraptor*?

A. Flexible thoracic part of the backbone.
B. Ability to fly.
C. Looking after offspring.
D. Outer integument with changing colour.
E. Constant (regulated) body temperature
3. The presence of feathers can only be deduced from indirect evidence since the protein they are made up of has broken down by now. Name the type of protein which makes up most part of the feathers.


4. The warts were found on the ulna. Name the body part which contains the ulna.


5. Modern birds all have feathers, but some species – like the ostrich – are not able to fly. Suppose that 10 million years from now somebody digs out an intact ostrich skeleton. Which of the following features will give away that this bird was incapable of flying? (2 points)

A. The lack of ulna.
B. Pelvic bone formed by the fusion of three bones.
C. Flat sternum.
D. Large keel of the sternum.
E. Small upper arm bone (humerus) relative to the body.

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VI. **Sex cells**

1. In the figure, human egg and sperm cells can be seen. Which one is the sperm cell? Write its letter on the lines below and support your answer.

   ……………………………………………
   ……………………………………………
   ……………………………………………
   ……………………………………………

2. Name the organ which produces
   a) egg cells: …………………………………………………………………………………
   b) sperm cells: ……………………………………………………………………………..

   (2 points)

Decide whether the following statements – about human sex cells – are true (T) or false (F) and write the correct letter in the box next to each statement.

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<td>3.</td>
<td>Both types of sex cells contain 46 chromosomes.</td>
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<td>4.</td>
<td>Sex cells meet their energy demands with the help of mitochondria found in them.</td>
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<td>5.</td>
<td>Sperm cells contain either X or Y sex chromosomes.</td>
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<td>6.</td>
<td>Sex cells are haploids (contain a single set of chromosomes).</td>
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<td>7.</td>
<td>An average of one egg cell matures each month.</td>
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<td>8.</td>
<td>Egg cells are most likely to be fertilised around the 14(^{th}) day of the menstrual cycle.</td>
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<td>9.</td>
<td>The sperm cells find their way to the urethra through the urinary bladder.</td>
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### VII. Muscles  

7 points

Write the letter of the correct muscle in the box(es) next to each statement.

- A. Facial muscle
- B. The flexor of the arm (biceps)
- C. Intercostal muscle elevating the ribs
- D. Extensor muscle of the lower leg
- E. Diaphragm

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<td>1.</td>
<td>It always relaxes during exhalation.</td>
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<td>2.</td>
<td>It is attached to the skin and plays an important role in communication.</td>
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<td>3.</td>
<td>It can be located on the humerus.</td>
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<td>4.</td>
<td>It separates the thoracic and abdominal cavities.</td>
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<td>5.</td>
<td>When it contracts, the distance between the toes and the rest of the body increases.</td>
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<td>6.</td>
<td>It is attached to a longitudinal bone.</td>
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<td>7.</td>
<td>When it contracts, the volume of the thoracic cavity is increased.</td>
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Mendel’s laws

The picture shows the garden of the Augustinian monastery where Mendel, one of the founders of genetics, carried out his experiments.

Mendel investigated, among others, the inheritance of the colour of pea seeds. The colour of the pea seed is determined by two alleles (‘A’ and ‘a’). The ‘A’ allele determines the dominant trait.

1. What is meant by ‘allele’? Write your answer on the dotted line.

………………………………………………………………………………………………………………

………………………………………………………………………………………………………………

2. What does the symbol ‘AA’, first used by Mendel, refer to in this pattern of inheritance? Write the letter of the correct answer into the box.

A. The colour of the pea seed.
B. The genotype of the plant for that particular trait.
C. The genotype of the gametes of the plant for that particular trait.
D. The two strands of the DNA helix which carries the given gene.
E. The pair of chromosomes (homologous chromosomes) determining that particular trait.

3. Mendel’s first law states – in modern interpretation – that the genotypes of plants in the F1 generation are all identical. In what conditions does this law hold true?

A. Only if the trait follows a dominant recessive inheritance pattern.
B. Only if both parents are a homozygous for the given trait.
C. Only if one of the parents shows the dominant and the other the recessive trait.
D. Only if the given trait is determined by two alleles of one gene
E. Only if the members of the first filial generation (F1) are all homozygous.

4. While crossing the plants, Mendel ruled out the possibility of random insect pollination. The second filial generation (F2) was brought about by self pollination, which means that the pollen from the stamen fertilised the egg cell of the same flower. What are the consequences of this method of pollination?

A. As a result of such pollination only homozygous plants can be produced.
B. As a result of such pollination all the offspring are sure to be heterozygous.
C. As a result of this pollination the genotype of all offspring will be identical with the genotype of the parents (if mutation is ruled out).
D. In this crossing the egg cells and the male sex cells contain ‘A’ and ‘a’ alleles in equal proportions.
E. The sex cells in this crossing will be diploids.
5. In his further studies Mendel examined two traits. Let us indicate the colour of the seed coat by ‘A’ and ‘a’ (yellow is dominant, green is recessive), the shape of the seed by ‘B’ and ‘b’ (the rounded is the dominant, the wrinkled the recessive). What does the abbreviation ‘AaBb’ stand for?

A. The genotype of plants with yellow, rounded seeds.
B. The genotype of plants with green, rounded seeds.
C. The genotype of plants with yellow, wrinkled seeds.
D. The genotype of plants with green, wrinkled seeds.
E. The genotype of gametes of heterozygous plants.

6. What might the symbol ‘ab’ stand for in the above crossing?

A. The genotype of sex cells produced by homozygous plants with yellow and round seed.
B. The genotype of plants with green and wrinkled seeds.
C. The genotype of plants with yellow and wrinkled seed.
D. The genotype of homozygous plants with green and wrinkled seed.
E. The genotype of sex cells produced by heterozygous plants.

7. A lot of the characteristics are partially or fully heritable and yet there are no exact proportions which could be expressed by small, integer numbers as described by Mendel. How can it be explained?

A. This is typical of the inheritance of tendencies/predispositions strongly influenced by environmental conditions.
B. Traits determined by many genes are inherited in this way.
C. This is what happens when the two alleles of one gene interact with one another.
D. Repeated inbreeding in successive generations will result in this.
E. This is what happens when individual experiences alter the structure of genes.

8. Mendel regarded genes as a mathematical concept and did not investigate either their substance or location. (This was not necessary for achieving his results anyway.) Today now we know where they are located and the substance they are made up of. Which statements are true for the eukaryotic genes according to our present knowledge?

A. RNA stretches of the chromosomes.
B. DNA stretches of the ribosomes.
C. The proteins of chromosomes.
D. The enzymes of the nucleus.
E. The DNA stretches of chromosomes.

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IX. Population and community  9 points

Certain characteristics only apply to certain levels of organisation. The characteristics of the lower levels of organisation cannot necessarily be interpreted at a higher level of organisation – and this is true the other way around, too. Match the characteristics below with the appropriate letter.

A. It can be interpreted for (it is characteristic of) a population.
B. It can be interpreted for (it is characteristic of) a community.
C. It can be interpreted for both.
D. It cannot be interpreted for either.

1. Average life span.
2. Sex (gender).
3. Species diversity.
4. Age (the time elapsed from the time of conception).
5. Seasonal changes.
6. The length of food chain.
7. Proportion of genders (the proportion of males and females).
8. Stratification (the vertical organisation of the populations involved).
9. Its protection can be justified.

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<td>I. Insects and Fish</td>
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<td>II. Dangerous relationships</td>
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<td>IV. Peculiar slimming diet</td>
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<td>V. Birds and Dinosaurs</td>
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<td>VI. Sex cells</td>
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<td>VII. Muscles</td>
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<td>VIII. Mendel’s laws</td>
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<td>IX. Population and community</td>
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<td><strong>Total</strong></td>
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The total score of the written examination (achieved score \( \cdot 1.25 \)) = \( 80 \cdot 1.25 = 100 \)

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marking teacher

Date: …………………………………..