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### Multiple Choice Questions

- Decide which of the choices best completes the statement or answers the question.
  - Locate that question number on the separate answer sheet provided.
  - Use the procedure described by your teacher to answer each question. For example, “fill in the circle that corresponds to your choice” or “make an X over the letter corresponding to your choice.”
1. Human development begins with fertilization. Which row below identifies the structure in which fertilization takes place and the number of chromosomes that are found in the fertilized egg?

Row	Structure	Number of Chromosomes in Fertilized Egg
a.	uterus	23 pairs
b.	uterus	46 pairs
c.	oviduct	23 pairs
d.	oviduct	46 pairs

2. Which of the following is NOT true of human sperm?
- a. Most sperm are destroyed as they try to make their way through the cervix and uterus.
  - b. Many sperm are destroyed by the acidic environment of the vagina.
  - c. Many sperm find their way into the oviduct that does not have an egg.
  - d. The nuclei of many sperm are necessary in order to restore the proper number of chromosomes in the zygote.
3. As the zygote undergoes cleavage, the number of cells increases but the overall size of each cell gets smaller. By the time the zygote reaches the 16-cell stage, it is called a
- a. trophoblast.
  - b. morula.
  - c. fetus.
  - d. gastrula.

*Use the following information to answer the next question.*

#### Prenatal Period of Development

This period of development takes place over the first eight weeks, or the first two-thirds of the first trimester. During this time, tremendous change takes place. Cells divide and become redistributed. Tissues and organs form.

4. The prenatal period of development described above is another term for the
- a. zygote period of development.
  - b. fetal period of development.
  - c. embryonic period of development.
  - d. placental stage of development.

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*Use the following information to answer the next two questions.*

### Home Pregnancy Tests

More than 40 years ago, the immunologic detection of human chorionic gonadotropin (hCG) for diagnosis of pregnancy replaced the bioassay. The sequence of immunologic milestones since then has taken early pregnancy detection out of the clinical laboratory and into the home. The discovery of pregnancy is often in the week following the first missed menstrual period (the 4th completed week since last menstrual period, or 4 weeks 0 days through 4 weeks 6 days), as determined by a urine home pregnancy test.

The most sensitive test of pregnancy is best performed by a laboratory using a blood sample. These tests not only detect hCG but also can indicate the amount (quantitative tests) of the hormone, which doubles every 2-3 days during the first several weeks of pregnancy. These more sensitive tests can tell how long since conception and even detect possible problems with the pregnancy. A healthcare provider can perform this test.

Initially, many women prefer the privacy, convenience, and quick results from home test kits. Home pregnancy tests are not as accurate as blood tests done by a healthcare provider. They also cannot determine if the pregnancy is developing as expected.

5. In the early stages of pregnancy, human chorionic gonadotropin (hCG) is released by the
  - a. placenta.
  - b. corpus luteum.
  - c. anterior pituitary gland.
  - d. trophoblast.
  
6. The function of hCG is to
  - a. maintain the corpus luteum past the time when it would otherwise degenerate.
  - b. stimulate cleavage and the formation of the morula.
  - c. digest some of the tissues and blood vessels of the endometrium.
  - d. stimulate gastrulation and the formation of the three germ layers.
  
7. Which of the following statements does NOT describe the hormone levels during pregnancy?
  - a. Early in pregnancy, hCG increases until it reaches maximum concentration near the end of the first trimester.
  - b. Early in pregnancy, progesterone is produced by the corpus luteum in the ovary.
  - c. Early in pregnancy, estrogen is produced by the corpus luteum in the ovary.
  - d. Early in pregnancy, follicle stimulating hormone is released by the anterior pituitary.
  
8. The series of events that form distinct structures of the developing organism is called
  - a. gastrulation.
  - b. morphogenesis.
  - c. neurulation.
  - d. parturition.

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9. Which row below matches the organ or body system with the germ layer that it develops from?

Row	Ectoderm	Mesoderm	Endoderm
a.	thyroid gland	nervous tissue	heart
b.	kidneys	sense organs	spleen
c.	outer skin	muscle tissue	pancreas
d.	cellular lining urinary bladder	eye lens	dermis of skin

10. Which of the following does NOT describe an event that occurs during the fourth week of development of an embryo?
- eyelids and irises form in the eyes
  - blood cells start to form and fill blood vessels
  - lungs and kidneys take shape
  - small buds, which will develop into the arms and legs, appear
11. Which extra-embryonic membrane is described by the following statement?  
“This fluid-filled sac protects the embryo from trauma as well as allowing freedom of movement, and prevents limbs from sticking to the body.”
- chorion
  - placenta
  - allantois
  - amnion
12. The placenta performs a number of functions throughout pregnancy. Which of the following is NOT a function of the placenta?
- transports nutrients from the mother’s blood to the fetus’s blood
  - forms the foundation for the umbilical cord and becomes part of the urinary bladder
  - transports wastes from the fetal blood to the mother’s blood
  - secretes hormones, such as estrogen, progesterone, and hCG
13. Which of the following events is most likely to occur in the fetus during the third trimester of pregnancy?
- Growth in length of the body accelerates, but growth of the head slows.
  - The bones of the skeleton begin to form, and fetal legs grow and develop.
  - Fetal brain cells form rapidly, connecting to form more intricate networks.
  - The cartilage-based skeleton begins to harden.

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*Use the following information to answer the next two questions.*

### **Alcohol and Pregnancy**

Mothers who consume alcohol during pregnancy are at an increased risk of having children with birth defects. FASD (fetal alcohol spectrum disorder) is a term that covers the full range of birth defects associated with alcohol consumption during pregnancy, including FAS (fetal alcohol syndrome) and FAE (fetal alcohol effects).

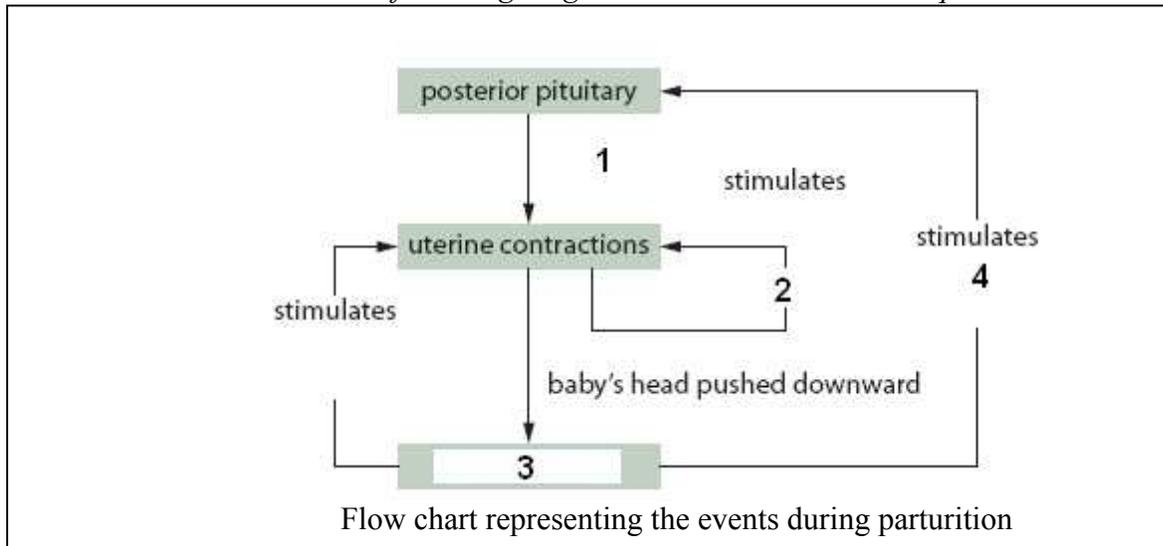
The diagnosis of FAS includes confirmation of drinking during pregnancy, and abnormalities in each of three categories: i) growth retardation, ii) central nervous system involvement such as hearing disorders, mental retardation, and brain malformations, and iii) characteristic face with narrow eye width, elongated, flattened midface, and thin upper lip.

The term fetal alcohol effects has come to mean a birth defect caused by alcohol ingestion during pregnancy in which some, but not all, of the symptoms related to FAS are present. FAE is not a milder form of fetal alcohol syndrome. Even though a child or adult with FAE has only some of the symptoms of fetal alcohol syndrome, those symptoms may have just as severe an effect on their life.

Source: [http://teacher.aadac.com/addiction\\_info/alcohol\\_beyond\\_abcs.asp#Alcohol\\_and\\_pregnancy](http://teacher.aadac.com/addiction_info/alcohol_beyond_abcs.asp#Alcohol_and_pregnancy)

14. In this context, alcohol consumed by the pregnant woman is acting as
- a carcinogen.
  - a teratogen.
  - an endocrine disruptor.
  - a neural tube defect.
15. In some cases, receiving inadequate amounts of a substance can also result in physical or development abnormalities. A lack of folic acid (vitamin B9) during pregnancy can have devastating consequences for embryonic development. The lack of folic acid in the mother's diet is linked to
- cancer in early childhood.
  - babies being born without limbs.
  - increased risk of premature births, stillbirths, and miscarriages.
  - neural tube defects.

Use the following diagram to answer the next two questions.



16. The hormone represented by number 1 on this flow chart is
- oxytocin.
  - estrogen.
  - prostaglandins.
  - progesterone.
17. Step 4 in this flow chart represents
- negative feedback that is under hormonal control.
  - negative feedback that is under neural control.
  - positive feedback that is under hormonal control.
  - positive feedback that is under neural control.
18. Prior to milk production, a breast-fed baby receives a yellowish fluid called colostrum from its mother. Which of the following is FALSE?
- Colostrum contains more protein than breast milk.
  - Colostrum contains less fat than breast milk.
  - Colostrum is thicker than breast milk.
  - Colostrum and breast milk contain antibodies from the mother.
19. Surgical sterilizations in men and women are called
- tubal ligation and vasectomy, respectively.
  - vasectomy and tubal ligation, respectively.
  - artificial insemination and in vitro fertilization, respectively.
  - in vitro fertilization and artificial insemination, respectively.

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20. Which of the following is NOT likely a cause of male infertility?
- obstruction of the ductus deferens or epididymis
  - low sperm count caused by over-heated testicles
  - low proportion of abnormal or non-viable sperm
  - erectile dysfunction or impotence

*Use the following information to answer the next two questions.*

### In Vitro Fertilization

In order to prepare a proper environment in the woman and to increase the chances of recovering several healthy and mature eggs, the woman will undergo about two weeks of intensive preparation. This will include hormonal therapy with “fertility drugs.” Blood tests and ultrasound scans of the ovaries are used to determine the optimal time to retrieve the eggs from the ovary. This optimal time is just before ovulation when the oocytes are almost ready for fertilization.

At the proper time, an outpatient procedure under local anesthesia will allow the female’s eggs to be visualized by ultrasound and retrieved from the ovary by placing a needle through the vaginal wall. The mild discomfort that the patient feels has been described as similar to a Pap smear or endometrial biopsy. After a short rest, the patient will be able to go home and resume normal activities.

The fluid from the follicles is examined under the microscope by the embryologist, who locates the eggs and keeps them in the laboratory under physiologic conditions. The embryologist will place the sperm with the eggs when they are ready for fertilization.

- Usually, the cells of the eggs will divide 2 or 3 times to become pre-implantation embryos. They are maintained in laboratory dishes, in a nutrient mixture that acts as a substitute for the environment that would otherwise have been provided by the mother.
- Using a special catheter, the couple’s pre-implantation embryos will be passed through the vagina and into the uterus at the time the embryos would normally have reached the uterus.

After the embryo placement in the uterus, the patient will lie quietly in a bed for about an hour and then will return home.

Source: <http://www.ivf.com/ivffaq.html>

21. The nutrient mixture referred to in Statement 1 in this article replaces the environment found in the mother’s
- ovary.
  - oviduct.
  - vagina.
  - uterus.

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22. Statement 2 in this article refers to the time that the embryos are allowed to develop before being implanted in the uterus. How many days AFTER fertilization would the embryos develop in the laboratory glassware?
- between five and seven days
  - between one and two days
  - between fifteen and seventeen days
  - between twenty and twenty-two days

*Use the following information to answer the next question.*

### Ectopic Pregnancy

An ectopic pregnancy occurs when the fetus starts to develop outside the womb (uterus). The most common site for an ectopic pregnancy is within a fallopian tube. However, in rare cases, ectopic pregnancies can occur in the ovary, the stomach area, and the cervix.

An ectopic pregnancy is usually caused by a condition that blocks or slows the movement of a fertilized egg through the fallopian tube to the uterus. This may be caused by a physical blockage in the tube.

Most cases are a result of scarring caused by a past infection in the fallopian tubes, surgery on the fallopian tubes, or a previous ectopic pregnancy. Up to 50 percent of women who have ectopic pregnancies have had inflammation of the fallopian tubes or pelvic inflammatory disease (PID).

Source: <http://www.nlm.nih.gov/medlineplus/ency/article/000895.htm>

23. Which of the following statements is NOT a reason why an ectopic pregnancy cannot be continued to term (birth)?
- the result could be monozygotic (identical) twins
  - there is insufficient room in the fallopian tube for the baby to develop
  - the fallopian tube will rupture, causing severe internal bleeding
  - there is a significant risk that the mother will die
24. Which row below completes the following statement?  
 “Hormonal medications may be taken to prevent conception. These artificial hormones mimic the effect of *i* and inhibit the release of *ii* and LH from the anterior pituitary. As a result, *iii* does not occur.”

Row	<i>i</i>	<i>ii</i>	<i>iii</i>
a.	GnRH	progesterone	implantation
b.	estrogen	prolactin	ovulation
c.	oxytocin	prostoglandins	gastrulation
d.	progesterone	FSH	ovulation

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25. Which of the following is NOT a teratogen?
- cigarette smoke, directly inhaled (first-hand smoke).
  - cigarette smoke indirectly inhaled (second-hand smoke)
  - IVF.
  - UVR.

### Numerical Response Questions

- Record your answer on the answer sheet provided.
- If an answer is a value between 0 and 1 (e.g., 0.25), record the 0 before the decimal place.

*Use the following information to answer the next question.*

Events from ovulation to implantation in random order.

- blastocyst
- zygote
- gastrulation
- morula

1. The order of these events from earliest to the latest is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. Record your **four-digit** answer in the numerical response section of the answer sheet.

*Use the following information to answer the next question.*

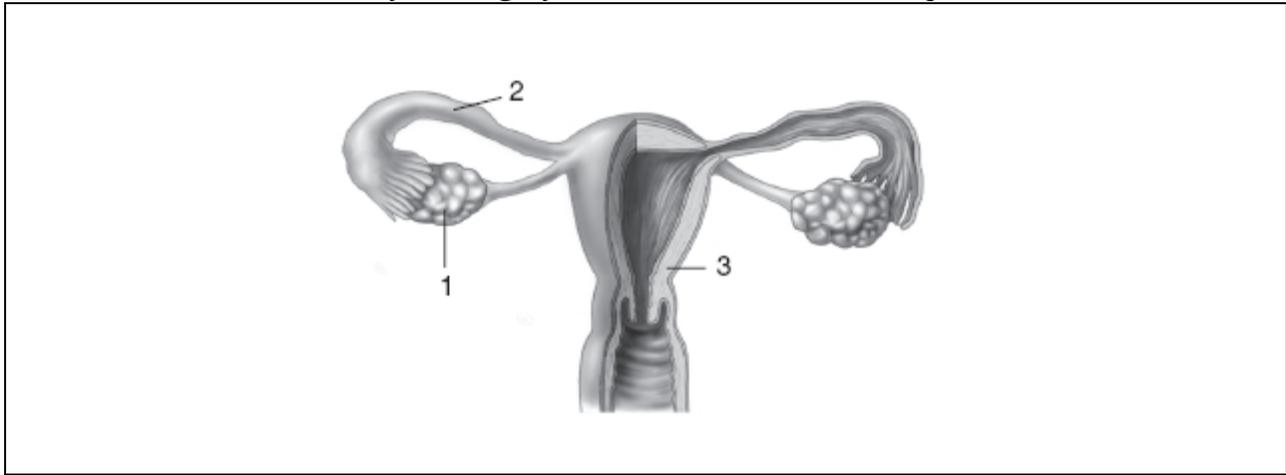
### Lactation and the Suckling Reflex

A suckling baby initiates the events that lead to milk secretion as well as milk production. The following events are in random order.

- hypothalamus produces oxytocin that is released by the posterior pituitary
- milk letdown occurs
- neural pathways carry stimuli to the hypothalamus
- oxytocin causes mammary lobules to contract
- suckling stimulates nerve endings in nipple and areola of the breast

2. The order of these events would be \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. Record your **five-digit** answer in the numerical response section of the answer sheet.

Use the following information to answer the next question.



3. Match the number on the diagram of the female reproductive system to the following statements.
- Statement A: This is the site where the sperm fertilizes the egg.
- Statement B: This where the zygote undergoes cleavage.
- Statement C: This is the site of ovulation.
- Statement D: This is the site of implantation.

Number:

Statement:

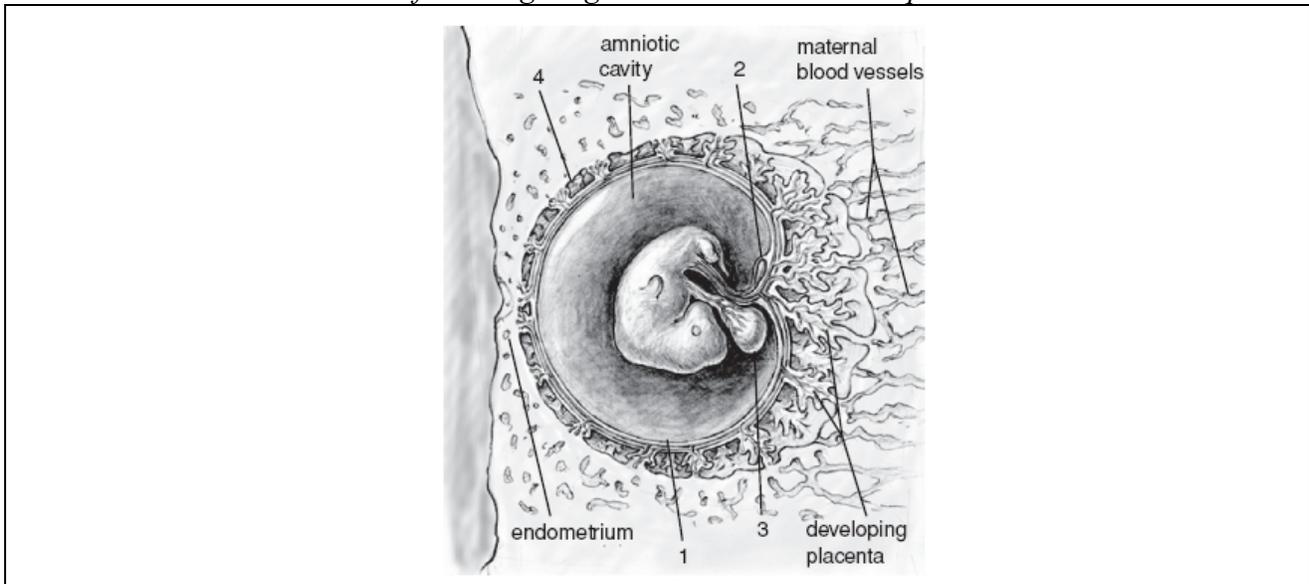
          
A

          
B

          
C

          
D

Use the following diagram to answer the next question.



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4. Using the preceding diagram, correctly match the number that corresponds to the extra-embryonic membranes named below. Record your **four-digit** answer in the numerical response question on the answer sheet.

**Number:**

**Structure:**

\_\_\_\_\_ **chorion**

\_\_\_\_\_ **allantois**

\_\_\_\_\_ **amnion**

\_\_\_\_\_ **yolk sac**

### Written Response Question

*Use the following information to answer the next questions.*

#### The Placenta

By the end of the second week after fertilization, finger-like projections from the chorion extend into the uterine lining. These projections, called chorionic villi, establish the beginnings of the placenta. The placenta is a disk-shaped organ that is rich in blood vessels. The embryo (or fetus) is attached to the uterine wall by the placenta.

The placenta is fully developed by about 10 weeks, with a mass of about 600 g.

One part of the placenta—the chorion tissue—comes from the embryo. The other part consists of blood pools from the mother's circulatory system. The blood systems of the mother and embryo are separate, but they lie very close to each other.

The functions of the placenta include:

- transports oxygen from the mother to the fetus and carbon dioxide from the fetus to the mother
- transports nutrients (for example, glucose, amino acids, fatty acids, minerals, and vitamins) from the mother's blood to the fetus's blood
- transports antibodies from the mother into the fetus's blood to provide passive immunity
- secretes hormones, such as estrogen, progesterone, and human chorionic gonadotropin
- stores nutrients, such as carbohydrates, proteins, iron, and calcium, in early pregnancy and releases them when fetal demand is greater than the mother can absorb from her diet
- transports wastes (such as urea, ammonia, and creatine) from the fetal blood to the mother's blood
- allows hormones from the fetus to diffuse into the mother's blood and hormones from the mother to diffuse into the fetus's blood

1. a) **Classify** the roles played by the placenta based on their nutritional, respiratory, excretory, circulatory, endocrine, and immune functions (5 marks)

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- b) **Explain** why the blood systems of the mother and embryo would lie in close proximity to each other but are separate. (3 marks)

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- c) **Explain** the negative effects on the embryo and fetus of a woman who smokes tobacco products while she is pregnant. Base your answer on how nutrients and gases are exchanged between the mother and fetus. (3 marks)

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*Use the additional information to answer the next question.*

#### **Umbilical Cord**

Near the end of the eighth week, as the yolk sac shrinks and the amniotic sac enlarges, the umbilical cord forms. The umbilical cord is a rope-like structure that averages about 60 cm long and 2 cm in diameter. It leads from the navel area of the fetus to the centre of the placenta.

- d) **Infer** the function of the umbilical cord. (2 marks)

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*Use the additional information to answer the next question.*

### Fetal Circulation

Some of the blood in the umbilical vein finds its way into the inferior vena cava of the fetus. The inferior vena cava is a major vein connected to the heart.

Inside the fetal heart:

Blood enters the right atrium, the chamber on the upper right side of the heart. Most of the blood flows to the left side through a special fetal opening between the left and right atria, called the **foramen ovale**.

Blood then passes into the left ventricle (lower chamber of the heart) and then to the aorta (the large artery coming from the heart). Blood leaving the aorta enters the systemic and coronary circulatory systems.

Some of the blood leaving the aorta is sent to the head and upper extremities. After circulating there, the blood returns to the right atrium of the heart through the superior vena cava.

About one-third of the blood entering the right atrium does not flow through the foramen ovale, but, instead, stays in the right side of the heart, eventually flowing into the pulmonary artery.

Instead of blood flowing to the lungs to pick up oxygen and then flowing to the rest of the body, the fetal circulation shunts (bypasses) most of the blood away from the lungs. In the fetus, blood is shunted from the pulmonary artery to the aorta through a connecting blood vessel called the **ductus arteriosus**.

- e) **Infer** why much of the blood that enters the right atrium of the fetal heart is shunted through the foramen ovale directly into the left ventricle. (2 marks)

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- f) **Explain** why much of the blood in the fetal circulation system is shunted away from the lungs into the aorta through the ductus arteriosus. (2 marks)

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