

Science Exam

This exam is composed of three parts:

Physics

Chemistry

Life science

Part I - Physics

Answer the physics questions on the attached "Physics Answer Sheet" by crossing the letter that corresponds to the right answer.

1. The document below shows eight successive positions occupied by a vehicle at constant time intervals. The speed of the vehicle:

M1	M2	M3	M4	M5	M6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- a) increases.
- b) decreases.
- c) increases then decreases.
- d) decreases then increases.

2. A ball A attached to a thread has a uniform circular motion with a speed v . A ball B thrown on the floor has a uniform rectilinear motion with the same speed v .

- a) The acceleration of A is greater than that of B.
- b) The acceleration of B is greater than that of A.
- c) A and B have the same acceleration that is null.
- d) A and B have the same acceleration that is different from zero.

3. During the freefall of an object, its acceleration:

- a) increases.
- b) decreases.
- c) is a constant different from zero.
- d) is null.

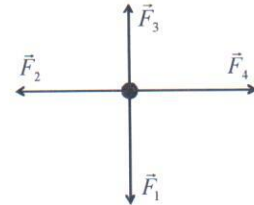
4. An object of mass m is released from an altitude of 9 m. During its motion, its mechanical energy equals 270 J. The mass m of the object equals: ($g = 10 \text{ m/s}^2$)

- a) 1,5 kg
- b) 3 kg
- c) 4 kg
- d) 6 kg

5. Four forces, $\vec{F}_1, \vec{F}_2, \vec{F}_3, \vec{F}_4$ are exerted on an object with a uniform rectilinear motion in the direction of \vec{F}_4 . The arrows in the diagram below indicate the direction of the four forces but not their lengths.

Between the following relations, which one relates the lengths of the forces $\vec{F}_1, \vec{F}_2, \vec{F}_3, \vec{F}_4$?

- a) $F_4 = F_2$ and $F_3 = F_1$
- b) $F_4 > F_2$ and $F_3 > F_1$
- c) $F_4 > F_2$ and $F_3 = F_1$
- d) None of the above.



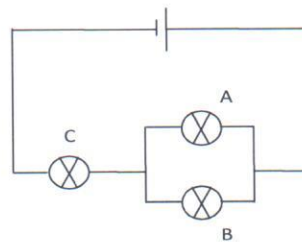
6. On a plane AB inclined by an angle $\alpha = 30^\circ$ to the horizontal, a solid S ($m = 10 \text{ kg}$) slides down a distance of 2m. The work done by the weight of the solid is equal to

($g = 10 \text{ m/s}^2$; $\sin 30^\circ = 1/2$; $\cos 30^\circ = \sqrt{3}/2$):

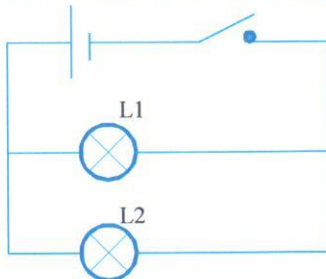
- a) 0J
- b) 20J
- c) 50J
- d) 100J

7. In the circuit below, three identical bulbs A, B and C are connected to an ideal drycell. If another identical bulb is added in parallel to bulb C, the current across bulb C:

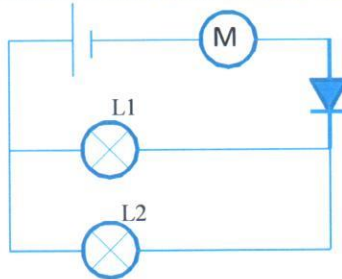
- a) stays the same.
- b) is halved.
- c) is doubled.
- d) becomes null.



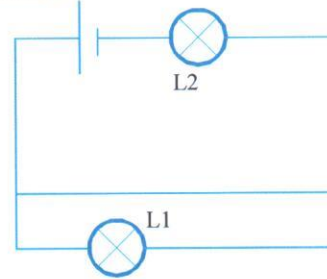
8. In which of the following circuits both bulbs L1 and L2 shine?



(A)



(B)



(C)

- a) A
- b) B
- c) C
- d) None of the above.

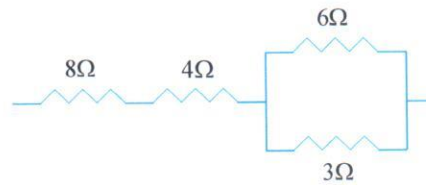
9. In a residential installation supplied with a voltage of 220V, we turn on two lamps 220V / 50W, an iron 220V / 200W and a dryer 220V / 500W.

What will be, in kWh, the value of the energy consumed if we leave these elements turned on for two hours?

- a) 0.5 kWh
- b) 1 kWh
- c) 2 kWh
- d) None of the above.

10. The equivalent resistance of the 4 resistances connected according to the following assembly is:

- a) 12.5
- b) 14
- c) 21
- d) 24



11. When a sunlight falls on a soap bubble, bright bands of color are seen. This is due to:

- a) dispersion.
- b) interference.
- c) pigments in the soap.
- d) refraction.

12. Which of the following radiations has the shortest wavelength?

- a) Infrared light
- b) Ultraviolet light
- c) Visible light
- d) X-rays

13. Sound travels fastest in:

- a) air.
- b) steel.
- c) a vacuum.
- d) water.

14. The index of refraction of water is 1.33. The speed of light in water in m/s is approximately:

- a) 2.25×10^8
- b) 2.25×10^7
- c) 3.99×10^8
- d) 3.99×10^7

15. An increase in temperature of 54 Celsius degrees is equal to an increase of:

- a) 54 Kelvin degrees.
- b) 219 Kelvin degrees.
- c) 327 Kelvin degrees.
- d) 454 Kelvin degrees.

16. A wave with a frequency of 20 cycles per second, travels with a speed of 100 m/s. What is the wavelength of this wave?

- a) 0.2 m
- b) 5 m
- c) 20 m
- d) 2 m

17. When a wave is reflected from a surface, there is a change in the wave's:

- a) frequency.
- b) direction.
- c) speed.
- d) wavelength.

18. A pulse in a spring transmits:

- a) energy, only.
- b) mass, only.
- c) both energy and mass.
- d) neither energy nor mass.

19. The change in direction which occurs when a wave passes obliquely from one medium into another is called:

- a) diffraction.
- b) interference.
- c) refraction.
- d) superposition.

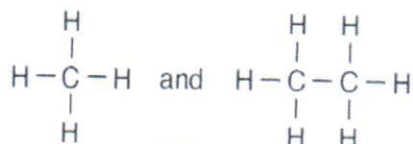
20. We pour 3 liters of water at 30 °C in a recipient containing 5 liters of water at the same temperature. What is the temperature of the mixture?

- a) 20 °C
- b) 30 °C
- c) 45 °C
- d) 60 °C

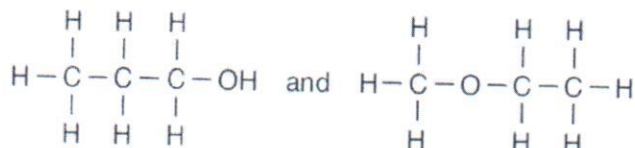
Part II. Chemistry

Circle the correct answer on the "Answer Sheet".

1. Which formulas represent compounds that are isomers of each other?



(a)



(c)



(b)

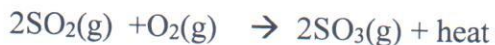


(d)

2. What is the oxidation number of manganese in KMnO_4 ?

- (a) +7
(b) +2
(c) +3
(d) +4

3. Given the equation representing a reaction at equilibrium:



Which change causes the equilibrium to shift to the right?

- (a) adding a catalyst
(b) adding more $\text{O}_2(\text{g})$
(c) decreasing the pressure
(d) increasing the temperature

4. Which equation represents a single replacement reaction?

- (a) $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$
(b) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
(c) $\text{H}_2\text{SO}_4 + \text{Mg} \rightarrow \text{H}_2 + \text{MgSO}_4$
(d) $\text{HCl} + \text{KOH} \rightarrow \text{KCl} + \text{H}_2\text{O}$

5. Which compounds are classified as Arrhenius acids?

- (a) HCl and NaOH
(b) HNO_3 and NaCl
(c) NH_3 and H_2CO_3
(d) HBr and H_2SO_4

6. Which change results in the formation of different substances?

- (a) burning of propane
(b) melting of $\text{NaCl}(\text{s})$
(c) release of $\text{CO}_2(\text{g})$ into air
(d) solidification of water

7. Given the balanced equation representing a reaction: $O_2 \rightarrow O + O$
What occurs during this reaction?
- (a) Energy is absorbed as bonds are broken. (c) Energy is released as bonds are broken.
(b) Energy is absorbed as bonds are formed. (d) Energy is released as bonds are formed.
8. Which substance **can not** be broken down by a chemical change?
- (a) ammonia (c) propanal
(b) ethanol (d) zinc
9. The greatest amount of energy released per gram of reactants occurs during a
- (a) redox reaction (c) substitution reaction
(b) fission reaction (d) neutralization reaction
10. Which polyatomic ion is found in the compound represented by the formula $NaHCO_3$?
- (a) acetate (c) hydrogen sulfate
(b) hydrogen carbonate (d) oxalate
11. Two forms of solid carbon, diamond and graphite, differ in their physical properties due to the differences in their:
- (a) atomic numbers (c) isotopic abundances
(b) crystal structures (d) percent compositions
12. Salt water is classified as a:
- (a) compound because the proportion of its atoms is fixed
(b) compound because the proportion of its atoms can vary
(c) mixture because the proportion of its components is fixed
(d) mixture because the proportion of its components can vary
13. The elements in Group 2 have similar chemical properties because each atom of these elements has the same
- (a) atomic number (c) number of electron shells
(b) mass number (d) number of valence electrons
14. The coefficients in a balanced chemical equation represent the:
- (a) mass ratios of the substances in the reaction
(b) mole ratios of the substances in the reaction
(c) total number of electrons in the reaction
(d) total number of elements in the reaction

15. What occurs at one of the electrodes in both an electrolytic cell and a galvanic cell?

- (a) Oxidation occurs as electrons are gained at the cathode.
- (b) Oxidation occurs as electrons are lost at the anode.
- (c) Reduction occurs as electrons are gained at the anode.
- (d) Reduction occurs as electrons are lost at the cathode.

16. A 25.0 mL sample of a 0.100 mol L⁻¹ hydrochloric acid solution completely reacted with 23.4 mL of sodium hydroxide solution.

What volume of the same sodium hydroxide solution would be required to completely react with 25.0 mL of a 0.100 mol L⁻¹ acetic acid solution?

- (a) less than 23.4 mL
- (b) 23.4 mL
- (c) more than 23.4 mL
- (d) unable to calculate unless the concentration of the sodium hydroxide solution is also known

Given: Na = 23 H = 1 Cl = 35.5 O = 16

17. What is the main environmental problem associated with chlorofluorocarbon compounds?

- (a) acid rain
- (b) eutrophication
- (c) global warming
- (d) ozone depletion

18. The concentration of a solution can be expressed in:

- (a) milliliters per minute
- (b) mole per liter
- (c) grams per kelvin
- (d) joules per gram

19. Which class of organic compounds contains nitrogen?

- (a) aldehyde
- (b) alcohol
- (c) amine
- (d) ether

20. Which balanced equation represents nuclear fusion?

- (a) ${}^3_1\text{H} \rightarrow {}^3_2\text{He} + {}^0_{-1}\text{e}$
- (b) ${}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + {}^4_2\text{He}$
- (c) ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He}$
- (d) ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{90}_{38}\text{Sr} + {}^{143}_{54}\text{Xe} + 3 {}^1_0\text{n}$

III- BIOLOGY

Tick ONE correct answer ONLY on the Biology Answer Sheet

- 1- Which of the following is a *hypothesis*?
 - A. the growth of a green plant is usually affected by air pollution.
 - B. is the growth of a green plant affected by air pollution?
 - C. determine whether the growth of a green plant is usually affected by air pollution.
 - D. air pollution is caused by the excessive burning of fossil fuels.

- 2- Ozone hole refers to
 - A. hole in ozone layer
 - B. decrease in the ozone layer in troposphere
 - C. decrease in thickness of ozone layer in stratosphere
 - D. increase in the thickness of ozone layer in troposphere

- 3- Pollination is best defined as
 - A. transfer of pollen from anther to stigma
 - B. germination of pollen grains
 - C. growth of pollen tube in ovule
 - D. visiting flowers by insects

- 4- Most fish do not sink in water because of the presence of
 - I. swim bladder
 - II. air bladder
 - III. air sacs
 - IV. air in spongy bones

Which of the following answer is correct?

- A. I and II are correct
 - B. II and III are correct
 - C. III and IV are correct
 - D. I, II, III and IV are correct
-
- 5- Plants synthesis protein from
 - A. starch
 - B. sugar
 - C. amino acids
 - D. fatty acids

6- One day you wake up with a sore throat and a runny nose. Your doctor takes a swab from your throat, sends it to a lab, and calls you the following day to tell you that antibiotic would not help you get better

Which of the following is the most likely reason for the doctor's statement?

- A. having waited a day, it is too late to take an antibiotic
- B. you need an antiseptic, not an antibiotic
- C. you need to be vaccinated instead of taking an antibiotic
- D. you are infected by a virus

7- Most abundant tissues of our body are

- A. muscular
- B. connective
- C. epithelial
- D. nervous

8- Plants are killed in winter by frost because

- A. of desiccation and mechanical damage to the tissues
- B. no photosynthesis takes place at such low temperature
- C. respiration ceases at such low temperature
- D. there is no transpiration

9- Potato is a modified form (outgrowth) of

- A. root
- B. stem
- C. fruit
- D. leaf

10- O₂ released in the process of photosynthesis comes from

- A. CO₂
- B. water
- C. sugar
- D. pyruvic acid

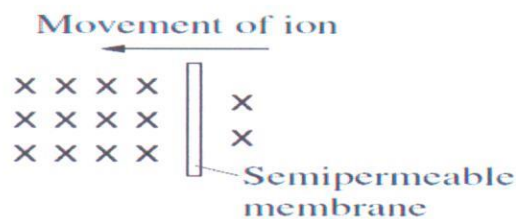
11- Infectious diseases can be spread when microbial experiments are conducted. Which of the following would be an effective barrier to stop this from happening?

- A. using chlorinated water during the experiment
- B. washing hands before performing the experiment
- C. wearing plastic or latex gloves during the experiment
- D. disposing carefully and safely of waste materials produced during the experiment.

12- What does the structure of arteries allow them to do?

- A. transport oxygen rich blood
- B. withstand high blood pressure
- C. release carbon dioxide to the lungs
- D. remove nitrogenous waste via the kidneys

- 13- What causes a healthy human heart to beat regularly?
- nerve impulses from the brain
 - specialized tissues in the heart
 - hormones present in the blood
 - electrical signals from the spinal cord
- 14- Antibodies are proteins that
- break down pathogens.
 - bind with a specific antigen.
 - catalyze biochemical reactions.
 - are produced by T cells to kill disease-causing viruses.
- 15- Which of the following can cause an imbalance of microflora in humans?
- overuse of antibiotics
 - excessive use of antiviral drugs
 - consumption of genetically modified foods
 - immunization against different diseases
- 16- Which of the following prevents the entry of pathogens into the human body?
- skin cell death
 - mucus lining the respiratory tract
 - phagocytosis performed by B cells
 - destruction of pathogens by the lymphatic system
- 17- What is the genotype of pure breeding plants?
- heterozygous
 - homologous
 - homozygous
 - monohybrid
- 18- The diagram shows a model of the movement of ions (represented by X) across a semipermeable membrane.



- What type of process is modeled in the diagram?
- osmosis
 - filtration
 - diffusion
 - active transport

19- What are the main components of the immune response involved in organ rejection?

- A. antibodies, T cells and B cells
- B. antibiotics and white blood cells
- C. T cells, B cells and red blood cells
- D. red blood cells, white blood cells and antigens

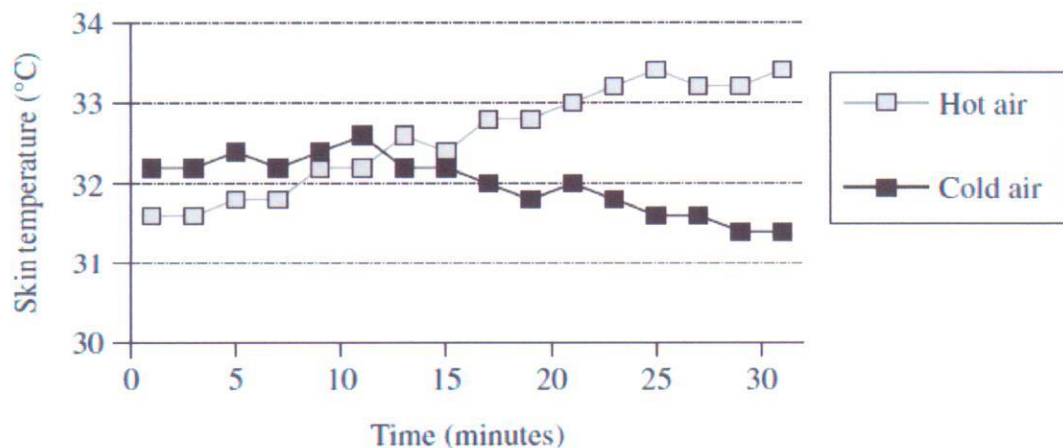
20- Why does the human stomach produce chemicals which lower the pH?

- A. to assist in the breakdown of fats
- B. to assist in the breakdown of protein
- C. to neutralize the saliva from the mouth
- D. to neutralize juices from the small intestine

21- Vaccination can control the spread of

- A. a genetic disorder.
- B. an infectious disease.
- C. a nutritional deficiency.
- D. an environmental disease.

22- Two experiments were conducted where either cold air or hot air was blown continuously onto a student's legs while the skin temperature on the student's arm was being measured. The graph shows the change in skin temperature on the arm of the student for each experiment.



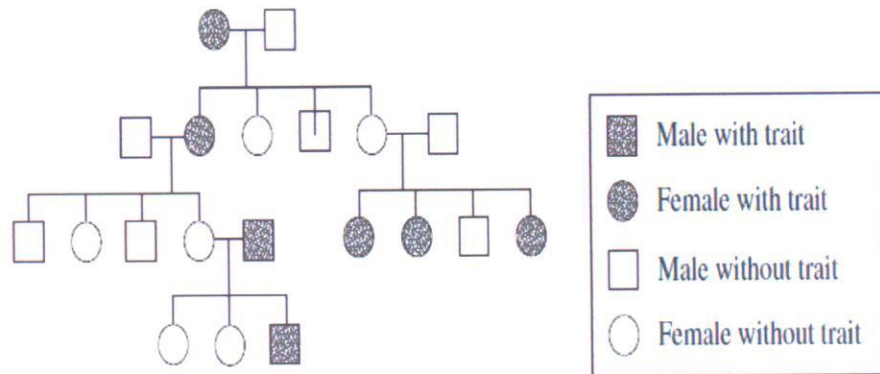
Which process best accounts for the trends shown in the graph?

- A. diffusion
- B. osmosis
- C. homeostasis
- D. inflammation

23- What is the function of an artificial heart valve?

- A. it prevents the backflow of blood.
- B. it filters cholesterol from the blood.
- C. it produces a regular electrical impulse.
- D. it allows blood to move from the ventricle to the atrium

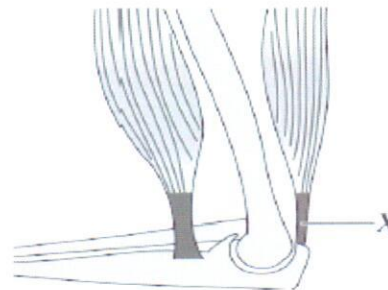
24- A family tree is shown



What is represented by this family tree?

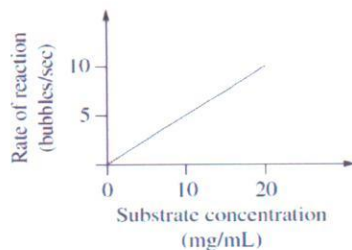
- A. sex-linked inheritance
- B. co-dominant inheritance
- C. inheritance of a recessive trait
- D. inheritance of a dominant trait

25- What is structure X in the elbow joint shown?



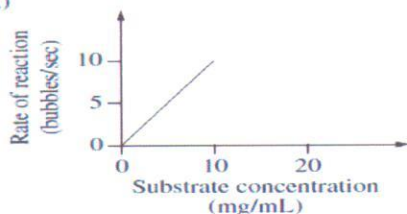
- A. bone
- B. cartilage
- C. muscle
- D. tendon

26- The graph shows the rate at which bubbles are produced in an enzymatic reaction at 36°C

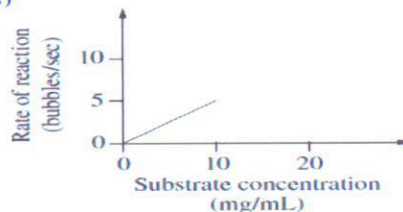


Which of the following graphs shows the results of the enzyme reaction carried out at 18°C?

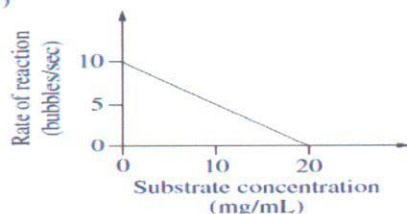
(A)



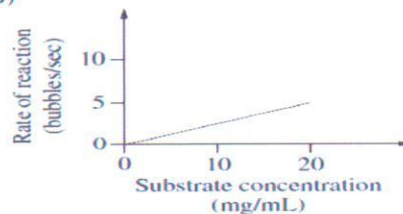
(B)



(C)



(D)



27- The following data were collected about heart rate and exercise from a large number of participants.

Group number	Age (years)	Sex	Average weight (kg)	Average resting heart rate before exercise (beats/min)	Average resting heart rate after two minutes of exercise (beats/min)
1	25	Male	75	70	130
2	25	Female	65	75	140
3	45	Male	85	75	150
4	45	Female	85	80	160
5	65	Male	80	75	145
6	65	Female	80	85	150

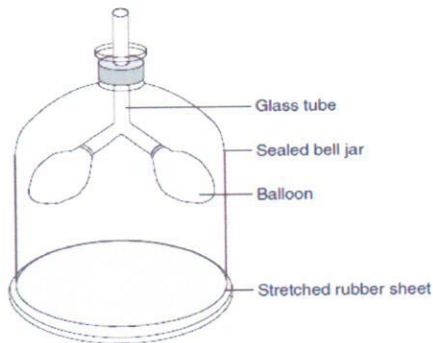
Which statement is consistent with the data?

- A. females have a greater increase in heart rate than males after exercise.
- B. the younger a person is, the greater the increase in heart rate after exercise.
- C. the more a person weighs, the greater the increase in heart rate after exercise.
- D. the lower the resting heart rate, the greater the increase in heart rate after exercise

28- One function of the small intestine is to break down

- A. bacteria
- B. fats
- C. glucose
- D. vitamins

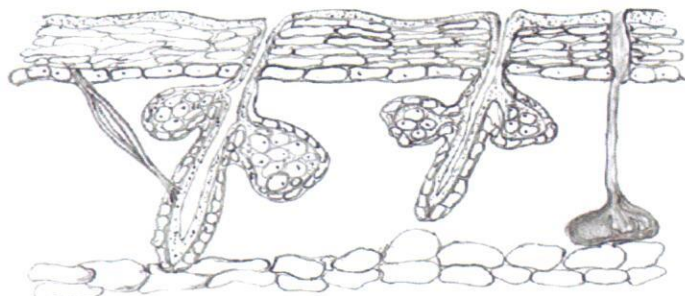
29- This apparatus was used to model the process of breathing.



Which statement relates the use of this model to the process of inhaling?

- A. pushing the stretched rubber sheet upward causes the balloons, representing the lungs, to inflate
- B. pulling the stretched rubber sheet downward causes the balloons, representing the lungs, to inflate
- C. blowing air into the glass tube inflates the balloons causing the stretched rubber sheet to move downward
- D. sucking air out of the glass tube causes the stretched rubber sheet to move upward, representing the contraction of the diaphragm

30- A tissue sample was observed through a microscope. A student recorded the observation as a diagram



What tissue is represented by the diagram?

- A. capillary
- B. muscle
- C. bone
- D. skin

31- Which of the following correctly identifies the relationship between alleles, chromosomes and genes?

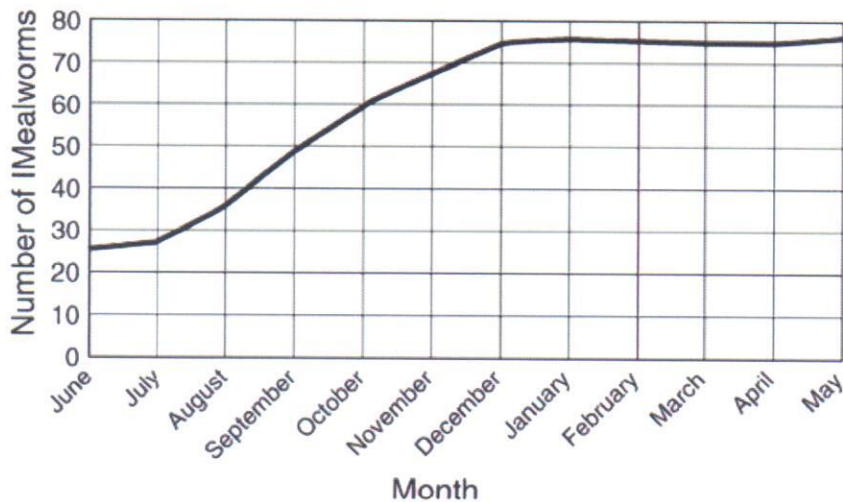
- A. genes contain chromosomes and alleles.
- B. chromosomes contain genes but not alleles.
- C. alleles are found in chromosomes but not in genes.
- D. genes are parts of chromosomes and have different alleles.

32- Compared to sexual reproduction, asexual reproduction results in a:

- A. greater variation in offspring
- B. larger number of identical cells
- C. longer life span of a cell
- D. lower number of cells dividing

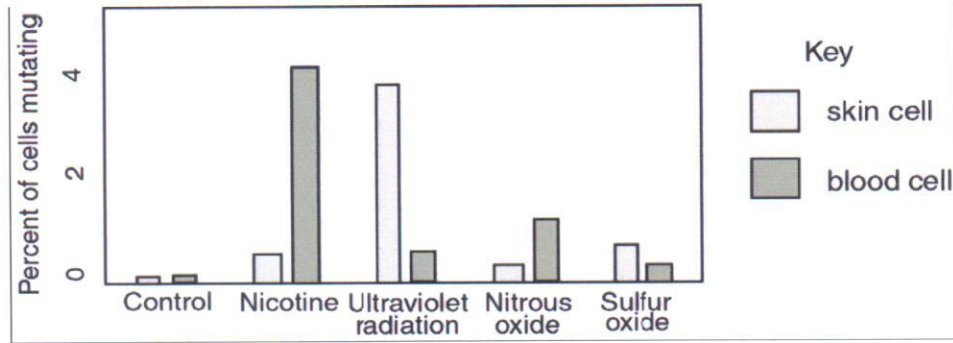
33-The graph below shows the number of mealworms (mealworm) in a community over a period of twelve months. From this graph, what conclusion can we do about the population of mealworms?

Mealworm Population

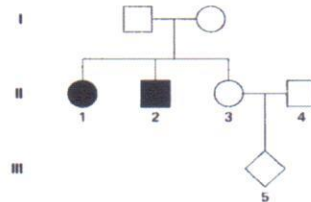


- A. some mealworms are older than others
- B. mealworms hibernate in April
- C. the population contains carnivorous mealworms
- D. the population of mealworms reaches its maximum capacity in December

- 34- The graph below shows the effect of 4 mutagenic that affect human blood cells and skin cells that are cultured in laboratory. One conclusion that could be drawn from this graph is:



- A. human cells are affected equally by the mutagenic
 B. mutagenic affect cells in different ways
 C. nitrous oxide affects both blood and skin cells
 D. nicotine is equally offensive to all cells
- 35- Which of the following is a description of mutualism?
 A. both species exploit a common essential resource
 B. one of the species is more complex than the other
 C. both species benefit from each other
 D. no species interact with the other
- 36- In witch part of the DNA is genetic information located?
 A. hydrogen bonds
 B. nucleotide sequences
 C. sugar molecules
 D. enzymes
- 37- Unlike mitosis, meiosis only exists in:
 A. reproductive cells
 B. muscle cells
 C. connective tissue cells
 D. nervous cells
- 38- The analysis of the following pedigree representing the transmission of disease shows that
 A. the allele responsible for the disease is recessive
 B. the allele responsible for the disease is dominant
 C. the allele responsible for the disease is supported by a gonosome
 D. the probability that the individual II3 is heterozygous is 1%



N.B. The number of individuals heterozygous for the gene is estimated at 1%.

- 39- The pulmonary artery is a blood vessel that
- A. enters the heart through the right ventricle
 - B. enters the heart through the right atrium
 - C. leaves the heart from the left ventricle
 - D. leaves the heart from the right ventricle
- 40- Amongst these cells, which ones have the property of phagocytosis?
- A. Plasma cells
 - B. Macrophages
 - C. The red blood cells
 - D. Sperm

Good Luck

LEBANESE UNIVERSITY
FACULTY OF EDUCATION

ENTRANCE EXAM
September, 2014
Duration: 2 hours

Science Exam
Answer sheet

1.	a	b	c	d
2.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
6.	a	b	c	d
7.	a	b	c	d
8.	a	b	c	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d
12.	a	b	c	d
13.	a	b	c	d
14.	a	b	c	d
15.	a	b	c	d
16.	a	b	c	d
17.	a	b	c	d
18.	a	b	c	d
19.	a	b	c	d
20.	a	b	c	d

Part II: Chemistry Exam

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d
11	a	b	c	d
12	a	b	c	d
13	a	b	c	d
14	a	b	c	d
15	a	b	c	d
16	a	b	c	d
17	a	b	c	d
18	a	b	c	d
19	a	b	c	d
20	a	b	c	d

III- Biology Answer sheet

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|----|---|---|---|---|----|---|---|---|---|
| 1 | A | B | C | D | 21 | A | B | C | D |
| 2 | A | B | C | D | 22 | A | B | C | D |
| 3 | A | B | C | D | 23 | A | B | C | D |
| 4 | A | B | C | D | 24 | A | B | C | D |
| 5 | A | B | C | D | 25 | A | B | C | D |
| 6 | A | B | C | D | 26 | A | B | C | D |
| 7 | A | B | C | D | 27 | A | B | C | D |
| 8 | A | B | C | D | 28 | A | B | C | D |
| 9 | A | B | C | D | 29 | A | B | C | D |
| 10 | A | B | C | D | 30 | A | B | C | D |
| 11 | A | B | C | D | 31 | A | B | C | D |
| 12 | A | B | C | D | 32 | A | B | C | D |
| 13 | A | B | C | D | 33 | A | B | C | D |
| 14 | A | B | C | D | 34 | A | B | C | D |
| 15 | A | B | C | D | 35 | A | B | C | D |
| 16 | A | B | C | D | 36 | A | B | C | D |
| 17 | A | B | C | D | 37 | A | B | C | D |
| 18 | A | B | C | D | 38 | A | B | C | D |
| 19 | A | B | C | D | 39 | A | B | C | D |
| 20 | A | B | C | D | 40 | A | B | C | D |