

## **BIOLOGY**

1. Cells store energy when:
  - A. they break down sucrose to glucose and fructose
  - B. the third phosphate group breaks off from an ATP molecule
  - C. a third phosphate group is bonded to an ATP molecule
  - D. ions are released into the bloodstream
  
2. Organisms that do not use oxygen and die in the presence of oxygen are called:
  - A. obligate aerobes
  - B. facultative aerobes
  - C. obligate anaerobes
  - D. facultative anaerobes
  
3. Which vector and pathogen are correct?
  - A. mosquito — sleeping sickness
  - B. tick — Chagas disease
  - C. mosquito — malaria
  - D. fly — Lyme disease
  
4. Ovulation is a process where:
  - A. sperm are ejected from the penis
  - B. an egg is produced and brought to maturity
  - C. a zygote implants on the uterine wall
  - D. an egg is released from the ovary

## CHEMISTRY

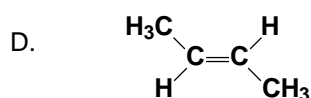
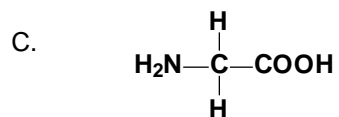
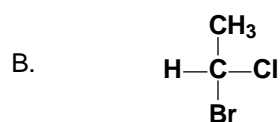
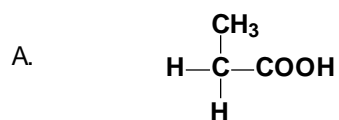
1. Reaction between butene and chlorine is:

- A. Addition;
- B. Condensation;
- C. Polymerisation;
- D. Free radical substitution.

2. How many hydrogen atoms are contained in one mole of ethanol, C<sub>2</sub>H<sub>5</sub>OH?

- A. 5;
- B. 6;
- C.  $1.0 \times 10^{23}$ ;
- D.  $3.6 \times 10^{24}$ .

3. Which one of the following molecules exhibits optical activity?



4. The subatomic particles found in the nucleus of atom are:

- A. neutrons and electrons;
- B. electrons and protons;
- C. protons and neutrons;
- D.  $\beta$ -particles and protons.

## PHYSICS

1. An image given by a convex (diverging) mirror is always:

- A. real, upright, magnified
- B. virtual, upright, diminished
- C. real, inverted, magnified
- D. virtual, inverted, diminished

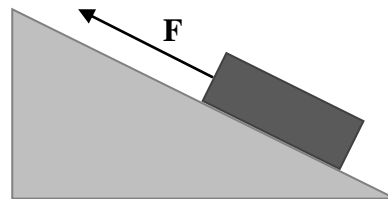
2. Calculate acceleration due to gravity at the surface of Mars ( $g_M$ ).

Data:  $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$ ,  
radius of Mars:  $R_M = 3.4 \times 10^6 \text{ m}$ ,  
mass of Mars:  $m_M = 6.42 \times 10^{23} \text{ kg}$

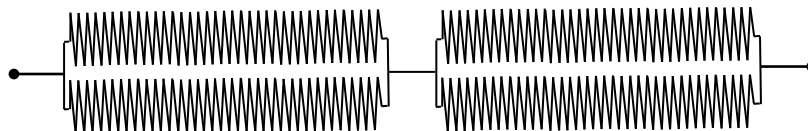
- A.  $g_M = 3.7 \text{ m/s}^2$
- B.  $g_M = 8.7 \text{ m/s}^2$
- C.  $g_M = 10.7 \text{ m/s}^2$
- D.  $g_M = 8.9 \text{ m/s}^2$

3. A brick of mass  $m = 1 \text{ kg}$  is placed on an inclined plane that makes an angle of  $30^\circ$  with the horizontal (see the figure below). The static and kinetic friction coefficients between the brick and the plane are:  $f_{st}=0.50$ ,  $f_k=0.45$ . The values of force  $F$  applied to the brick which is at rest are: 1N, 5N or 9N. The body remains at rest:  
(hint:  $g = 10 \text{ m/s}^2$ )

- A. only when  $F = 1 \text{ N}$
- B. only when  $F = 5 \text{ N}$
- C. only when  $F = 9 \text{ N}$
- D. for all three values of applied force



4. The force constant of a single spring that obeys the Hook law is  $k$ . The effective force constant of the springs system shown in the figure, composed of four identical springs joined by rigid elements is:



- A.  $k$
- B.  $2\cdot k$
- C.  $3\cdot k$
- D.  $4\cdot k$

