15th International Kangaroo Science Contest 2022

Junior Level (Class 9 & 10)

Time Allowed: 90 minutes

All Questions Worth 4 Points

Atomic masses: *O - 16, Ca - 40; H - 1; Na - 23; Cl - 35.5; C - 12; P - 31, Si - 28, Al - 27, K - 39, N - 14*

1. Which of the following statements is true about the human eye?

A) The crystalline eye lens plays the role of a divergent lens

B) Virtual images of objects are formed on retina

C) Accommodation for clear vision is achieved by deforming the retina

D) The minimum distance of clear vision for a normal healthy eye is 25 *mm*

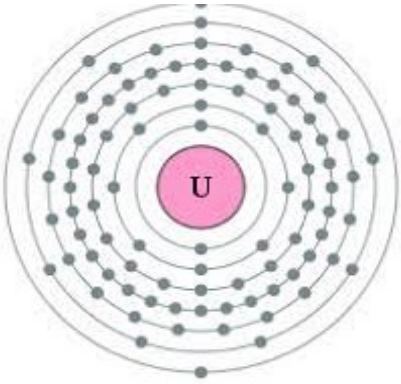
E) The farthest point up to which the eye can see objects clearly is called far point

2. The best sources of energy for our body are:

A) Proteins **B)** Salt **C)** Vegetables

D) Carbohydrates **E)** Vitamins

3. All the isotopes of uranium have:



A) The same atomic number, the same mass number

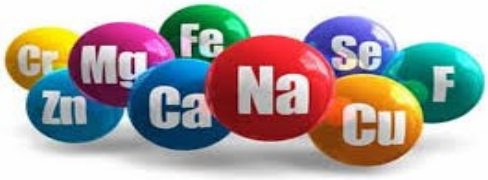
B) The same mass number, but different atomic numbers

C) The same atomic number, but different mass numbers

D) Different atomic and mass numbers

E) An equal number of protons and neutrons

4. Which of the following is a common characteristic of sodium and iron?



A) They can form alloys **B)** They have the same color

C) They are soft **D)** They are stored in petroleum

E) They are water-resistant, in the dark

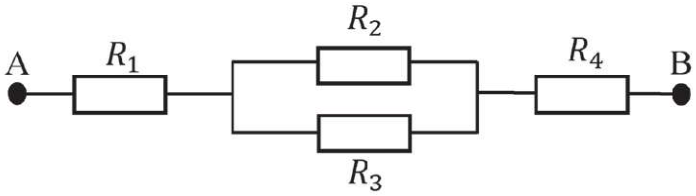
5. Which of the following belongs to the category of synthetic organic substances?

A) Chalk **B)** Sulfuric acid **C)** Carbide

D) Cellulose **E)** Plastic products

6. Knowing that resistors R_1, R_2, R_3, R_4 are all equal in value, select the correct relation among the equivalent resistances of the following electrical circuits:

i)



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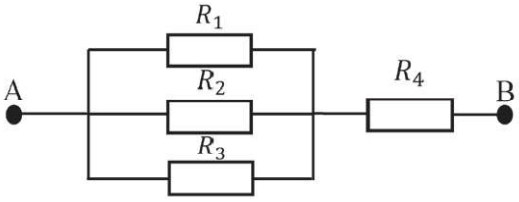
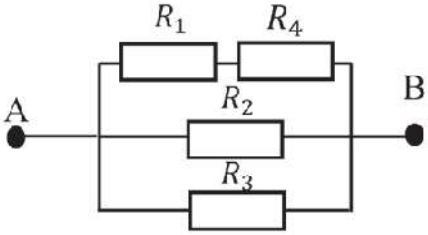


iii)



Note that R_i denotes the equivalent resistance of the circuit (i), and so on.

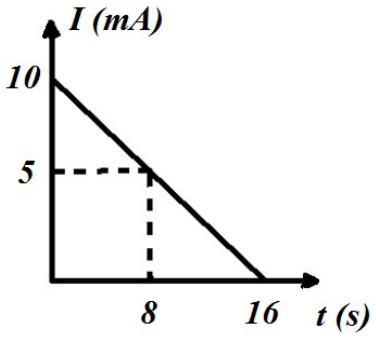
A) $R_i=R_{iii}<R_{ii}$ **B)** $R_{iii}<R_{ii}<R_i$ **C)** $R_i=R_{ii}=R_{iii}$

D) $R_{ii}>R_i>R_{iii}$ **E)** $R_i+R_{ii}=R_{iii}$

7. Which of the following is an advantage of plastic materials?

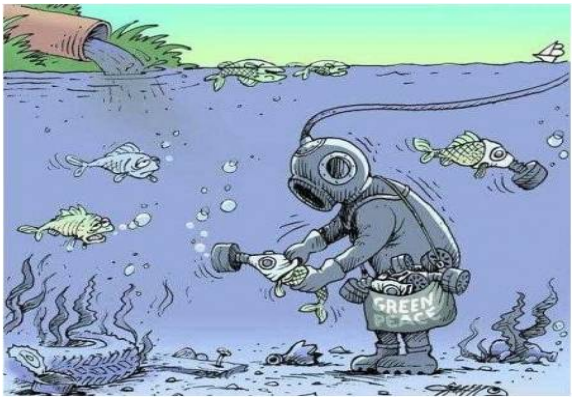
A) They are flammable
B) They have low density
C) They are breakable
D) They are susceptible to scratching
E) They do not pollute

8. The electric current I through a conductor varies with time t as shown in the graph. The amount of electric charge passing through a cross-section of the conductor in the time interval t_1 = 0s to t_2 = 8s is equal to:



A) 60*mC*
B) 16*mC*
C) 64*mC*
D) 32*mC*
E) 8*mC*

9. Which of the following are chemical pollutants of drinking water?



A) Parasites
B) Radioactive waste
C) Herbicides
D) Bacteria
E) Microorganisms

10. Which of the following is true about astigmatism?

A) Astigmatism cannot be corrected
B) Astigmatism can be corrected by spherical lenses
C) Astigmatism can be corrected by cylindrical lenses
D) Astigmatism can be corrected by converging lenses
E) Astigmatism can be corrected by divergent lenses

11. The main component in the planet's atmosphere is:

A) Nitrogen **B)** Oxygen **C)** Carbon dioxide
D) Hydrogen **E)** Water

12. Many electronic devices that emit ultrasound are used to drive away rodents and insects from our homes. Why these devices do not bother human inhabitants?

A) The ultrasounds are pleasing to the human ear
B) The intensity of the emitted ultrasound is very low
C) The ultrasound frequency is too low to be perceived by the human ear
D) The ultrasound frequency is too high to be perceived by the human ear
E) Humans perceive ultrasound as music

13. A chemical element has 3 electrons on its last layer. Which of the following statements is true for this element?

A) Its nucleus charge is 3+
B) It is found in the third period
C) It is the third element in the periodic table
D) It is found in the third main group
E) It is a reactive nonmetal

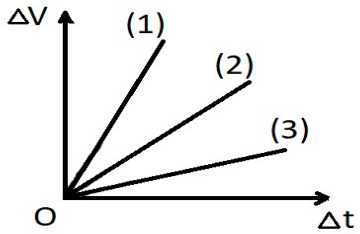
14. During the uniform circular motion of an object:

A) the period of the motion and the rotational frequency are directly proportional
B) the acceleration is zero since the speed is constant
C) the object travels equal arcs in equal time intervals
D) the acceleration exerted on the object is tangent to the trajectory
E) the velocity has a radial direction

15. An element used for stomach diagnosis using X-rays, is found in the sixth period and second group of the periodic table. We can say that:

A) It is a divalent metal
B) It is a divalent nonmetal
C) It has 6 electrons on the last layer
D) It has 2 layers completely occupied with electrons
E) It hardly reacts because it has a large mass

16. The figure below shows the linear graphs of the volume variation (ΔV) with the temperature (Δt) for three quantities of water that are in each of the three states of aggregation. Identify the correct association between the linear graph and the aggregation state:



A) 1-liquid, 2-solid, 3-gas **B)** 1-solid, 2-gas, 3-liquid **C)** 1-solid, 2-liquid, 3-gas
D) 1-gas, 2-solid, 3-liquid **E)** 1-gas, 2-liquid, 3-solid

17. Five chlorine molecules contain:

A) 5 chlorine atoms
B) 10 chlorine atoms
C) $5 \times 6.022 \times 10^{23}$ chlorine atoms
D) 6.022×10^{23} chlorine atoms
E) 15 chlorine atoms

18. Three resistors of resistances *R*, *2R* and *3R* are first connected in parallel, then in series. The ratio between the equivalent resistance of the series and the parallel connections is:

A) 6/1 **B)** 11/1 **C)** 36/11

D) 11/36 **E)** 36/1

19. A salt has the atomic ratio of Ca:P:O = 3:2:8. We can say that the salt:

A) Has the chemical formula $Ca_2 (PO_4)_3$

B) Contains 20% Ca

C) Has 155g/mol molar mass

D) Is a covalent substance

E) Is the salt of phosphoric acid

20. Which of the following statements is true about the moment of a force with respect to an axis?

A) It is equal to the product of the force value and the distance from the axis to the point of application of the force

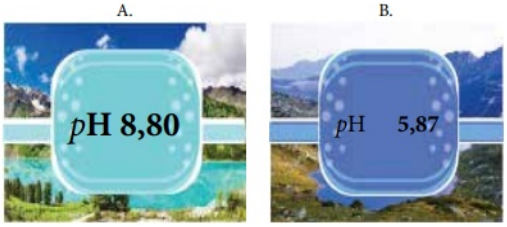
B) Its SI unit of measurement is J

C) It is zero if the direction of the force is parallel to the axis of rotation

D) It will never be zero if the direction of the force intersects the axis of rotation

E) It is proportional to the distance from the axis to the direction of the force

21. We can say that:



A) The water in image A is rich in carbon dioxide

B) If we add phenolphthalein in the water in image A, we will not notice any changes in color.

C) The water in image B is an alkaline water

D) The water in image B is rich in carbon dioxide

E) Both types of water are inappropriate for consumption because none of them have pH = 7.

22. We have two identical electric charges, located in a vacuum, at a distance "*d*" from each other. If we double the distance between charges, their interaction force:

A) doubles **B)** is halved **C)** increases four times
D) decreases four times **E)** increases $\sqrt{2}$ times

23. Burning coal represents a threat to climate balance due to carbon dioxide emissions. Although the greenhouse effect increases with carbon dioxide emissions, coal is still used as a fuel. If we burn 1500 kg of coal with 80% by mass of C, the volume of carbon dioxide released will be:

A) 2240 m^3 **B)** 2.24 m^3 **C)** 2800 m^3
D) 2.8 m^3 **E)** 1.5 m^3

24. The induced magnetic field is in the opposite direction to the inductive magnetic field when:

A) The inductive magnetic flux decreases
B) The electric current that generates the inductive magnetic field increases
C) The inductive magnetic flux increases
D) The inductive current decreases
E) The induction flow rate is high

25. Chemical fertilizers contain all the elements of the series:

A) N, Na, Cl, P **B)** N, K, P, O
C) C, Na, P, Cl **D)** Zn, C, Na, Ca
E) O; N; Cl, S

26. If a parallel beam of light passes through a flat surface separating two media with different refractive indices, the refracted beam shall be:

A) convergent
B) divergent
C) convergent or divergent depending on the refractive indices of the two media
D) parallel
E) parallel only under the conditions of total refraction

27. A man moves on a rectilinear trajectory that forms an angle α with the surface of a plane mirror, with constant speed v. Determine the relative speed with which man approaches his image in the mirror

A) $2v$ **B)** $2v\ cos\ \alpha$ **C)** $v\ sin\ \alpha$

D) $v\ cos\ \alpha$ **E)** $2v\ sin\ \alpha$

28. The electromotive voltage induced by a decreasing magnetic flux:

A) is positive **B)** is zero **C)** is negative

D) has the same sign as the variation of the inductive magnetic flux

E) does not depend on the change of the inductive magnetic flux

29. Which of the following is an energy source for plants?

A) Cellulose **B)** Starch **C)** Salt

D) Acetic acid **E)** Albumin

30. If we pour drops of concentrated sulfuric acid on a sugar cube, we will notice:

A) A strong yellow coloring **B)** The cube blackening **C)** The cube melting

D) A strong shine **E)** The cube dissolving