

## MCQ ANSWER KEY

### CHEMISTRY ANSWERS

1	2	3	4	5	6	7	8	9	10
D	A	D	B	D	C	B	B	C	A

### Explanation

1. According to Graham's Law we can arrange gasses amount in the container B. A molecule with high molecular masses has a trace amount in gas mixture in container D.

#### Graham's Law

The rates of effusion of two different gases are inversely proportional to the square roots of their molar masses.

The answer is **D**



$$4/17 = 0.253 \text{ mol (NH}_3\text{)} \quad 4/36.45 = 0.11 \text{ mol (HCl)}$$

The mol of excess ammonia:  $0.253 - 0.11 = 0.1256 \text{ mol}$

$$\text{Area of circle: } S = \pi r^2 = 3.14 \times 5^2 = 78.54 \text{ cm}^2$$

$$\text{Volume of the cylinder: } V = Sh = 78.54 \times 16 = 1256.637 \text{ cm}^3 = 1.257 \text{ L}$$

If the stopcock is opened the total volume:  $2 \times 1.257 \text{ L} = 2.5133 \text{ L}$

Now we can use ideal gas equation for calculation of final pressure:

$$PV = nRT / P \cdot 2.5133 = 0.11 \cdot 0.082 \cdot 298 / P = \mathbf{1.22 \text{ atm}}$$

The answer for this question is **A**



4.5g Zn-----x coulomb

$$Q = I \cdot t / 13359.46 \text{ coulomb} = 3.5 \cdot 10^{-3} \cdot t / t = 13359.46 \text{ seconds} = 1060.3 \text{ hours}$$

4. Potassium carbonate and ammonium sulfate gave precipitate with barium nitrate solution. The medium of ammonium sulfate is acidic. Potassium carbonate solution's basic medium and basic solutions turn color of phenolphthalein solutions into pink, so the answer for this question is **B**

5. Sucrose is non electrolyte (3),  $\text{KNO}_3$  is strong electrolyte (1),  $\text{NH}_3$  and  $\text{CH}_3\text{COOH}$  are weak electrolytes (2)

The answer is, **D)** I-2, II-3, III-1, IV-2

6. The MM of NaF=42 g/mol

We can find the mol of NaF in the given solution and we calculate the mass of NaF in the solution.

200 ml=0.2L, (volume of the solution),  $0.05=x/0.2$ ,  $x=0.01$  mol

The mass of NaF:  $0.01 \times 42 = 0.42$

The answer is **C**

7. The position of metals shown in the periodic table given below;

[illegible]

Atomic radius increases from the top to the bottom.

According to this picture we can arrange the following increasing order of atomic size for metals

The answer is **B)**  $\text{Li} < \text{Na} < \text{Ca} < \text{Sr}$

8. High ionization and poor conductivity related to non-metals. So the answer is **B**

9. 34.4 grams of  $\text{CaSO}_4 \cdot n \text{H}_2\text{O}$ -----46.668 grams of  $\text{BaSO}_4$  is formed

X grams of  $\text{CaSO}_4 \cdot n \text{H}_2\text{O}$ ----- 233 g/mol  $\text{BaSO}_4$  is formed

$X=171.75$  grams/mol of hydrate is formed.

$X=171.75$  grams/mol-136 grams/moles of  $\text{CaSO}_4=35.75$  grams of water is formed.

$35.75/18=2$  moles of water, **n=2**

The answer is **C**

10. 12% of apple is fructose, so  $0.12 \times 86 = 10.32$  g

11	12	13	14	15	16	17	18	19	20
A	C	B	C	D	A	B	C	D	C

180 g/mol fructose -----release 2812 kJ/mol energy

10.32 g fructose-----release x kJ energy

$X = (10.32 \times -2812) / 180 = 161.2213$  kJ = 161221.3 J / 4.184 = 38532.82 cal = 38.532 kcal

The answer for this question is **A**

## PHYSICS ANSWERS

### Explanation

11. Since the total resistance of the ring is R, the resistance of an arc spanning the angle  $\alpha$  is  $R_1 = \frac{R\alpha}{2\pi}$ .

Similarly the resistance of the second arc will be  $R_2 = \frac{R(2\pi - \alpha)}{2\pi}$ . The two resistors are connected in parallel,

thus the total resistance is  $R = \frac{R_1 R_2}{R_1 + R_2} = \frac{R\alpha(2\pi - \alpha)}{4\pi^2}$ .

The current measured by the ammeter will be  $I = \frac{\mathcal{E}}{R} = \frac{4\epsilon\pi^2}{R\alpha(2\pi - \alpha)}$ .

The graph at choice A corresponds to this equation.

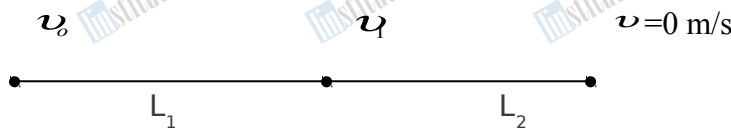
Correct answer: (A)

12. The heat delivered by the heater will be solely used to increase the temperature of the objects. For the first object  $Pt_1 = mc_1\Delta T$  and similarly for the second one  $Pt_2 = mc_23\Delta T$ . From these equations we obtain that

$$t_2 = \frac{3c_2t_1}{c_1} = 75 \text{ mins}$$

Correct answer: (C)

13. The motion of the object is described in the diagram below.



Object will acquire the maximum velocity just before it starts to decelerate. The relationship between maximum and initial velocity can be obtained from the kinematic relation  $v_1^2 = v_0^2 + 2aL_1$ . Afterwards the object will decelerate to stop  $v_1^2 = 2aL_2$ . Combining the two equations the acceleration can be written in terms of the initial velocity and the mentioned distances  $a = \frac{v_0^2}{2(L_1 - L_2)}$ .

The maximum velocity is obtained from the last two equations to be  $v_{\max} = v_0 \sqrt{\frac{L_2}{L_1 - L_2}} = v_0 \sqrt{\frac{k}{k-1}}$

Correct answer: (B)

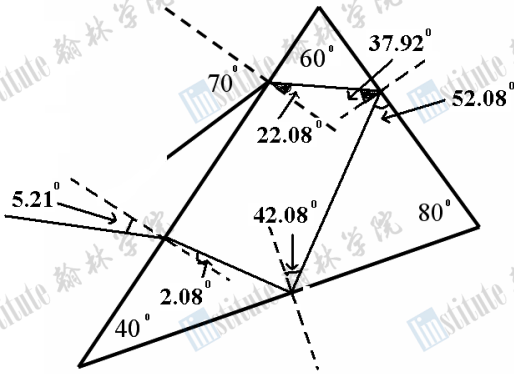
14. The critical angle for this material is  $\beta = \sin^{-1}\left(\frac{1}{n}\right) = 23.58^\circ$



The light will undergo total internal reflection as long as the angle is greater than this. The initial angle of refraction is calculated from the Snell's law

$$1 \times \sin 70 = 2.5 \times \sin \alpha \Rightarrow \alpha = 22.08^\circ$$

The light path inside the prism is described in the diagram below. The light will make 3 total internal reflections. At the 4<sup>th</sup> incidence, the angle will be less than the critical angle and the light will be able to escape the prism.



Correct answer : (C)

15. The acceleration of the object is computed from the given graph to be

$$a = \frac{\Delta v}{\Delta t} = 2.5 \frac{m}{s^2}$$

From the Newton's second law the equation for the acceleration is deduced to be  $a = g(\sin \alpha - f \cos \alpha)$ . Substituting the value of the acceleration found from the graph we obtain the angle of inclination to be  $\alpha = 28.6^\circ$ .

Correct answer: (D)

16.

Correct answer: (A)

17. The problem is similar to a collision problem where we can write the conservation of momentum  $m \times 2v + M \times v = (m + M) \times 1.2v$ . The relationship between the masses of the cart and the child will then be  $M = 4m$

Correct answer: (B)

18. The readings of the ammeters and the voltmeters in the two configurations are

$$I_1 = 0.5 A \quad V_1 = 3.2 V$$

$$I_2 = 1.0 A \quad V_2 = 2.6 V$$

For the circuit being studied, relationship between the readings of the ammeters and the voltmeters is

$$V_1 = \mathcal{E} - I_1 r$$

$$V_2 = \mathcal{E} - I_2 r$$

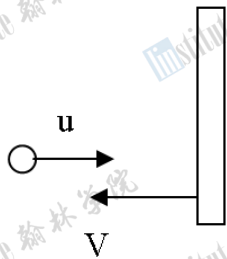
Canceling the internal resistance of the battery from the equations we end up with

$$\frac{\mathcal{E} - V_1}{\mathcal{E} - V_2} = \frac{I_1}{I_2}$$

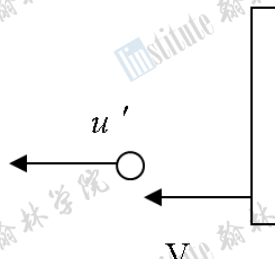
From here the EMF of the battery is calculated to be  $\mathcal{E} = 3.8$  Volt.

Correct answer : (C)

19.



Before collision



After collision

Velocity of ball relative to the large truck is  $u + V$  before collision. After collision relative velocity must be same. Therefore  $u' = u + 2V$

Correct answer: (D)

20. From the diagrams given in the content of the question we obtain that, the center of mass is at G

The distances from the edges to the center of mass are

$$GP=4 \quad GQ=\sqrt{13} \quad GR=\sqrt{17} \quad GS=\sqrt{25} \quad GT=\sqrt{18}$$

The potential energy will be maximum when the center of mass of the object is at its highest position, i.e. when it is hanged from Q. And the potential energy is minimum when the center of mass of the object is at its lowest position, i.e. when it is hanged from S.

Correct answer: (C)

### **BIOLOGY ANSWERS**

21	22	23	24	25	26	27	28	29	30
B	C	A	D	D	B	C	C	B	B