MULTIPLE CHOICE COMPETITION

SOLUTIONS

DECEMBER 4th 2019

MCQ Final

Q1
Answer D
Explanation
$\sum F \propto t^2$ (Given) ➔ $\frac{\Delta v}{\Delta t} \propto t^2$ $v \propto t^3$ $v^2 \propto t^6$ $E_k \propto v^2$ $E_k \propto t^6$

Q2
Answer C
Explanation
$$\sum F = 0$$ $$B - w_c - w_p = 0$$ $$m_w g - m_c g = m_p g n_p$$ $$\rho_w V_w - \rho_c V_c = m_p n_p$$ $$\pi r^2 h(\rho_w - \rho_c) = m_p n_p$$ $$n_p = \frac{\pi r^2 h(\rho_w - \rho_c)}{m_p}$$ $$n_w = \frac{\pi r^2 h(\rho_w - \rho_c)}{m_p}$$ $$n_o = \frac{\pi r^2 h(\rho_o - \rho_c)}{m_p}$$ $$\frac{n_w}{n_o} = \frac{(\rho_w - \rho_c)}{(\rho_o - \rho_c)}$$

Q3.
Answer D
Explanation
During light hours, algae carry out photosynthesis and release oxygen

Q4.
Answer B
Explanation
for i: is true because the bold lines signify a separation of phases. For ii: incorrect as lowering pressure does not change temperature for iii: Correct as it is the triple point. for iv: incorrect as the vapor pressure is equal to the atmospheric pressure (*i.e.* definition of boiling point) Therefore, I and iii are the correct answers.

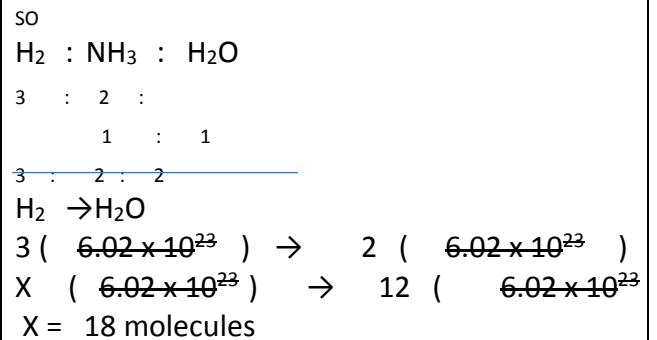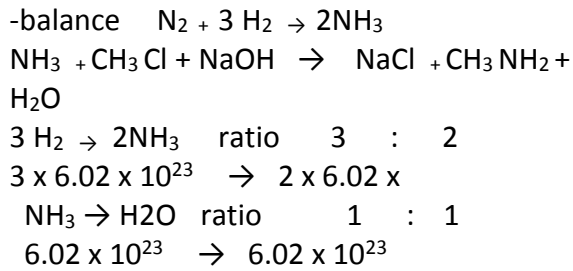| Q5 |
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| **Answer A** |
| **Explanation** |
| This is a dimensional analysis question |

starting with 12 molecules of water: in 1 molecule of water there is 1 molecule of NH_3; and in 2 molecules of NH_3 there are 3 molecules of H_2.

A second option: 12 molecules x (3/2) = 18 molecules

A third option is to convert molecules to moles and moles to molecules cancelling Avogadro's constant.

OR

-balance $\quad N_2 + 3 H_2 \rightarrow 2NH_3$ $NH_3 + CH_3 Cl + NaOH \rightarrow NaCl + CH_3 NH_2 + H_2O$ $3 H_2 \rightarrow 2NH_3 \quad$ ratio $\quad 3 \quad : \quad 2$ $3 \times 6.02 \times 10^{23} \rightarrow 2 \times 6.02 \times$ $\quad NH_3 \rightarrow H2O \quad$ ratio $\quad\quad 1 \quad : \quad 1$ $\quad 6.02 \times 10^{23} \rightarrow 6.02 \times 10^{23}$	so $H_2 \; : \; NH_3 \; : \; H_2O$ $3 \quad : \quad 2 \quad :$ $\quad\quad 1 \quad : \quad 1$ —————————— $3 \; : \; 2 \; : \; 2$ $H_2 \rightarrow H_2O$ $3 (\; \cancel{6.02 \times 10^{23}} \;) \rightarrow 2 (\; \cancel{6.02 \times 10^{23}} \;)$ $X \; (\; \cancel{6.02 \times 10^{23}}) \rightarrow 12 (\; \cancel{6.02 \times 10^{23}} \;$ $X = \; 18$ molecules

Q6.
Answer D
Explanation
Data from the figures

Q7.
Answer D
Explanation

	BT	Bt	bT	bt
Bt	BBTt Black long	BBtt Black short	BbTt Black long	Bbtt Black short

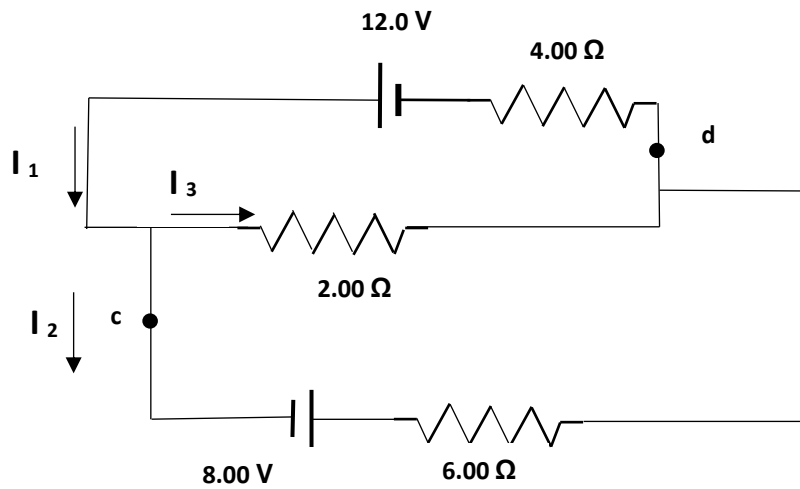| Q8. |
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| **Answer D** |
| **Explanation** |
| basic knowledge |
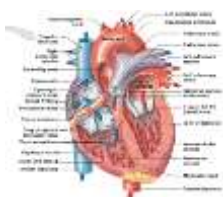
Q9.
Answer B
Explanation

$I_1 = I_2 + I_3$
$12.0 = 2.00I_3 + 4.00I_1$
$8.00 = 6.00I_2 - 2.00I_3$
Solving the equations 1,2,3 gives
$I_2 = 1.64\ A$
$I_3 = 0.909\ A$
$I_1 = 2.55\ A$

The potential difference between points c, d
$\Delta V = 2.00 \times I_3$
$\Delta V = 1.82\ V$
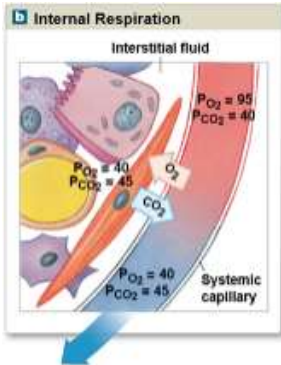*And point c with higher potential than point d*

Q10
Answer A
Explanation
basic knowledge

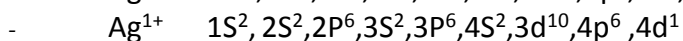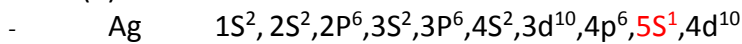| Q11. |
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| **Answer A** |
| **Explanation** |
| In (I) the trait appears in the father may be dominant or recessive. As the trait appears in females and not in males' children, therefore mother is not a carrier and the trait will not appear in females unless it is dominant **Therefore, it is X-linked dominant** In (II) As the trait doesn't appear in both parents and appears in the only males of their kids, the mother carries the trait as recessive. **Therefore, it is X-linked recessive.** |

Q12.
Answer C
Explanation
Energy level (n) = 5 is not included in the silver ion as the $4s^1$ electron is lost.

- Ag $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^{10}, 4p^6, 5S^1, 4d^{10}$
- Ag^{1+} $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^{10}, 4p^6, 4d^1$

Q13.
Answer C
Explanation

$$\theta_2 = sin^{-1}\left(\frac{n_1 sin\theta_1}{n_2}\right) = 23.7°$$
$$x_1 = h.\tan\theta_2 = 0.044m$$
$$\theta_3 = 28.9°$$
$$x_2 = 0.055m$$
$$x_3 = 0.084m$$
$$x_{net} = 0.183m = 18.3cm$$

Q14.
Answer C
Explanation

- $Cl_{2\,(g)} + 2e^- \rightarrow 2\ Cl^-_{\,(g)}$
- $Cl_{2\,(g)} \rightarrow 2\ \cancel{Cl}_{(g)}$ $\Delta H = R$
- $\cancel{Cl}_{(g)} + e^- \rightarrow Cl^-_{\,(g)}$ $\Delta H = S$
- $\cancel{Cl}_{(g)} + e^- \rightarrow\ Cl^-_{\,(g)}$ $\Delta H = S$
- Net reaction
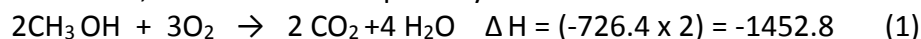- $Cl_{2\,(g)\,+}\ 2e^- \rightarrow 2\ Cl^-_{\,(g)}$ $\Delta H = R\ + 2S$

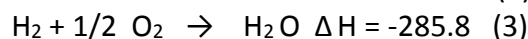| Q15. |
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| **Answer B** |
| **Explanation** |

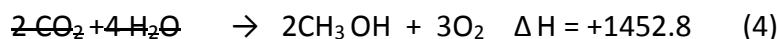Step 1: is to write the balanced combustion reaction of methanol to yield CO_2 and H_2O. Therefore, ΔH must be multiplied by 2.

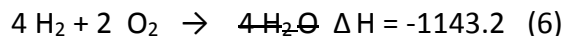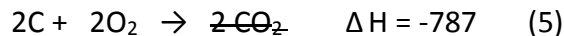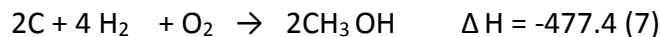$2CH_3\,OH\ +\ 3O_2\ \rightarrow\ 2\ CO_2 + 4\ H_2O$ $\Delta H = (-726.4 \times 2) = -1452.8$ (1)

Step 2:

  $C + O_2\ \rightarrow\ CO_2$ $\Delta H = -393.5$ (2)

  $H_2 + 1/2\ O_2\ \rightarrow\ H_2O$ $\Delta H = -285.8$ (3)

Step 3: Inverse equation (1)

$\cancel{2\ CO_2} + \cancel{4\ H_2O}\ \rightarrow\ 2CH_3\,OH\ +\ 3O_2$ $\Delta H = +1452.8$ (4)

Step 4: Multiply equation (2) x2 and equation (3) x 4

$2C +\ 2O_2\ \rightarrow\ \cancel{2\ CO_2}$ $\Delta H = -787$ (5)

$4\ H_2 + 2\ O_2\ \rightarrow\ \cancel{4\ H_2O}$ $\Delta H = -1143.2$ (6)

Step 5: By sum equations (4), (5) and (6)

$2C + 4\ H_2\ + O_2\ \rightarrow\ 2CH_3\,OH$ $\Delta H = -477.4$ (7)

Step 6: Divide (7) by 2

 $C + 2\ H_2\ + 1/2\ O_2\ \rightarrow\ CH_3\,OH$ $\Delta H = -238.7$ KJ/mol
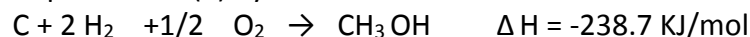
 OR:

 Step 1: write a balanced reaction and reverse the reaction, reversing the ΔH sign

 $CH_3\,OH\ +\ 3/2O_2\ \rightarrow\ 2\ CO_2 + 2\ H_2O$ $\Delta H = -726.4$ (1)

 $CO_2 + 2\ H_2O\ \rightarrow CH_3\,OH\ +\ 3/2O_2$ $\Delta H = +726.4$ (1)
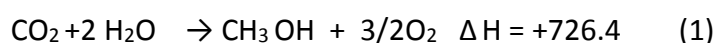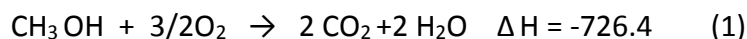
Q16.
Answer A
Explanation

At point F, the highest concentration is of HA and a slight (small) change in pH.

At point H, as KOH is added, HA is gradually converted to A^- (buffering region), . Beyond point G, the concentration of A^- is higher compared to HA.

Q17.

Answer D

Explanation

molar mass $C_8H_{10}N_4O_2$ = (8X12.011) +(1.008X10) +(4X14.007) +(2X15.999) = 194 g/mol

No. of moles in half Finjan= 2.05×10^{-3} g / 194 gmol^{-1} = 1.05×10^{-5} mol

Conc.in half-filled Finjan = 1.05×10^{-5} mol / 12.5×10^{-3} L = 0.084×10^{-2} M

No. of molecules in half Finjan = M . NA . V

No. of molecules in half Finjan
= 0.084×10^{-2} mol L^{-1} X 6.02×10^{23} molecule X 12.5×10^{-3} L = 6.321×10^{18} molecules

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Q18.

Answer A

Explanation

Water:
$m_w = 13.40 \ g$
$c_w = 4.184$
$\Delta t = (46.97 - 20)°C$

Gold:
$m_{Au} = (152 - m_{Cu}) \ g$
$c_{Au} = 0.129$
$\Delta t = (46.97 - 96.72)°C$

Copper:
$m_{Cu} = ?? \ g$
$c_{Cu} = 0.389$
$\Delta t = (46.97 - 96.72)°C$

$q_w = -(q_{Cu} + q_{Au})$
$4.184 \times 13.40 \times 26.97 = -((m_{Cu} \times 0.389 \times -49.75) + (152 - m_{Cu}) \times 0.129 \times -49.7$
$536.591 = 12.935 \ m_{Cu}$
$m_{Cu} = 41.483 \ g$

$$\% = \frac{41.483}{152} = 27.291\%$$

Q19.

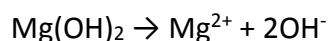**Answer B**

Explanation

$\rho_A g h_A = \rho_B g h_B$
$\rho_A \dfrac{3x}{2} = \rho_B x$
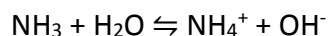$\dfrac{\rho_A}{\rho_B} = \dfrac{2}{3}$

Q20.

Answer B

Explanation

$Mg(OH)_2 \rightarrow Mg^{2+} + 2OH^-$

$Ksp = [Mg^{2+}] [OH^-]^2$

$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

$pOH = pKb + \log (\frac{[NH4+]}{NH3})$

pOH = (-log 1.77 x10^-5) + log (0.2073/ 0.7147)

pOH = 4.2145

$[OH^-]$ = 10^-4.2125

$[OH^-]$ = 6.1024x10^-5 M

$Ksp = [Mg^{2+}] [OH^-]^2$

1.2x10^-11 = $[Mg^{2+}]$ (6.1024x10^-5)²

$[Mg^{2+}]$ = 3.22x10^-3 M

Q21.

Answer C

Explanation

Nitrogen cycle

Syllabus: 5. System. Cycle: Nitrogen cycle

Q22.

Answer C

Explanation

An exothermic process, by definition, involves a reaction in which the products are lower in energy than the reactants. The reduction in chemical energy results in a release of heat from the reaction.

In the diagram, the path between points is irrelevant. We are simply looking for any instances in which the product point is below the reactant point. Point L has less energy than point K, and point N has less energy than K, L, or M. Transitions from K to L, M to N, or L to N will all result in a reduction of chemical energy, and a release of heat.

Q23.

Answer D

Explanation

$$\rho = \frac{2\pi.\pi.\pi^2.10^{-6}}{4.\pi.4\pi.10^{-2}}$$

$$\sigma = \frac{8}{\pi^2.10^{-4}} = 8.11 \times 10^3 \, \Omega^{-1}m^{-1}$$

Q24.

Answer A

Explanation

E = PE + KE

    E = mgh

    E ∝ h

   h_0 = 1.2 m

   h_1 = 1.2 x 0.84 = 1.008 m

   h_2 = 1.008 x 0.84 = 0.8467 m

d_O = 0.8467 m

   f = 0.5 m

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_O}$$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{do}$$

   d_i = 1.22 m

distance between the ball and its image = 1.22- 0.8467 =0.37 m

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Q25

Answer C

Explanation

$m\,g\sin\theta = E\,q\,\cos\theta$

$$\tan\theta = \frac{2.00 \times 10^3 \times 3.00 \times 10^{-6}}{4.00 \times 9.81 \times 10^{-3}}$$

$\theta = 8.69$

X = 20.0 sin 8.69 =3.02 cm

20.0 − z = 20.0 cos 8.69

Z = 0.230 cm

R = $\sqrt{3.02^2 + 0.230^2}$ = 3.03 cm

Q26.

Answer B

Explanation

$$\frac{\rho_b V_b g - \rho_w V_w g}{\rho_b V_b g} = \frac{kx_2}{kx_1}$$

$$\frac{x_2}{x_1} = \frac{17}{27}$$

Q27.

Answer B

Explanation

    Absorbent spectrum of light is high of the blue colour

Q28.

Answer C

Explanation

    Basic information of enzymatic activity and data in the table

Q29.

Answer C

Explanation

1. Explanation: 1: stay the same boiled (dead seeds)
2. : Soda lime is a chemical that absorbs carbon dioxide
3. : stay the same boiled (dead seeds)

  The gas pushes the fluid in the syringe

Q30.

Answer A

Explanation

$f_{d1} = f_s \left(\frac{v - v_d}{v - v_s} \right) = 500 \left(\frac{343 - 4.00}{343 - 30.0} \right) = 542$ Hz

$f_{d2} = f_s \left(\frac{v - v_d}{v - v_s} \right) = 500 \left(\frac{343 - (-4.00)}{343 - (-30.0)} \right) = 465$ Hz

$\Delta f_d = f_{d2} - f_{d1} = 465 - 542 = -0.76 \times 10^2$ Hz

Q	Answer				Strand
1	A	B	C	**D**	Physics
2	A	B	**C**	D	Physics
3	A	B	C	**D**	Biology
4	A	**B**	C	D	Chemistry
5	**A**	B	C	D	Chemistry
6	A	B	C	**D**	Biology
7	A	B	C	**D**	Biology
8	A	B	C	**D**	Biology
9	A	**B**	C	D	Physics
10	**A**	B	C	D	Biology
11	**A**	B	C	D	Biology
12	A	B	**C**	D	Chemistry
13	A	B	**C**	D	Physics
14	A	B	**C**	D	Chemistry
15	A	**B**	C	D	Chemistry
16	**A**	B	C	D	Chemistry
17	A	B	C	**D**	Chemistry
18	**A**	B	C	D	Chemistry
19	A	**B**	C	D	Physics
20	A	**B**	C	D	Chemistry
21	A	B	**C**	D	Biology
22	A	B	**C**	D	Chemistry
23	A	B	C	**D**	Physics
24	**A**	B	C	D	Physics
25	A	B	**C**	D	Physics
26	A	**B**	C	D	Physics
27	A	**B**	C	D	Biology
28	A	B	**C**	D	Biology
29	A	B	**C**	D	Biology
30	**A**	B	C	D	Physics