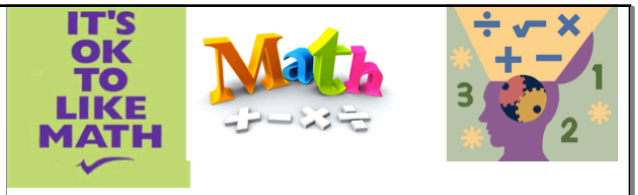
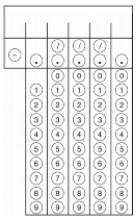


AP Biology Math Review

1)Take out an APPROVED calculator and fomula sheet.

2) Pick a grid sheet. You will solve each problem and grid in the answer.

Tips

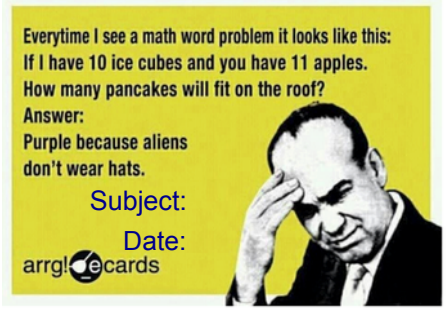


- Grid LEFT to right
- Use the formula sheet
- Don't round until the end

- Look at HOW the answer should be given "round to nearest…"

.123
The 1 is in the **tenths** place
The 2 is in the **hundreds** place
The 3 is in the **thousandths** place

Directions: Work on your problems, grid in your answers....after a bit I will turn on the NB presentation and you will also "click in" your answers!



You are smart! Use the Formulas provided!

AP Biology Math Review

start this quiz on previous page

#18 - bubble answer to "B" question

#19 - bubble answer to "A" question

#20 - bubble answer to "1600"

Q1: Chi Square

- A hetero red eyed female was crossed with a red eyed male. The results are shown below. Red eyes are sex-linked dominant to white, determine **the chi square value.** Round to the nearest hundredth.

Phenotype	# flies observed
Red Eyes	134
White Eyes	66

Chi Square Strategy

- Given—observed
- You have to figure out expected. Usually to do a Punnett square to figure this out
- Plug in $X^2 = \frac{(o-e)^2}{e} + \frac{(o-e)^2}{e} + \frac{(o-e)^2}{e}$

Observed—134 red eyes, 66 white eyes

Expected

	X^R	X^r
X^R	$X^R X^R$	$X^R X^r$
Y	X^R Y	X^r Y

3:1 ratio

134+ 66=200

150 red

50 white

Chi-Square

red white

$$X^2 = \frac{(o-e)^2}{e} + \frac{(o-e)^2}{e}$$

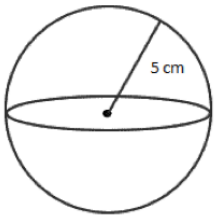
$$X^2 = \frac{(134-150)^2}{150} + \frac{(66-50)^2}{50}$$

$X^2 =$ 1.70666++ 5.12

$X^2 =$ 6.83

Q2: Surface Area and Volume

- What is the SA/V for this cell? Round your answer to the nearest hundredths.



Q2

Sphere

Surface Area $A = 4\pi r^2$

SA= 4 π^2

=4(3.14) 5^2

=314

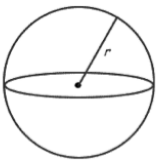
Volume of a sphere= 4/3 πr^3

=4/3 (3.14)5^3

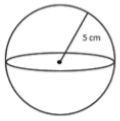
=523.33

SA/V=314/523.33

=.60



Volume $V = \frac{4}{3}\pi r^3$



Q3: Water Potential and Solution Potential

- Solute potential= –iCRT
- *i* = The number of particles the molecule will make in water; for NaCl this would be 2; for sucrose or glucose, this number is 1
- *C* = Molar concentration (from your experimental data)
- *R* = Pressure constant = 0.0831 liter bar/mole K
- *T* = Temperature in degrees Kelvin = 273 + °C of solution

Sample Problem

- The molar concentration of a sugar solution in an open beaker has been determined to be 0.3M. Calculate the solute potential at 27 degrees celsius. Round your answer to the nearest tenths.

Q3

- Solute potential= –iCRT

-i= 1

C= 0.3

R = Pressure constant = 0.0831

T= 27 +273=300K

Solute concentration= -7.5

Q4: Hardy Weinberg

- A census of birds nesting on a Galapagos Island revealed that 24 of them show a rare recessive condition that affected beak formation. The other 63 birds in this population show no beak defect. If this population is in HW equilibrium, what is the frequency of the dominant allele? Give your answer to the nearest hundredth

Hardy Weinberg Strategy

- Figure out what you are given
- Allele (p or q) or Genotypes (p2, 2pq, q2)
- Figure out what you are solving for
- Manipulate formulas to go from given to solving for
- Always dealing with decimals

Q4:Looking for p—dominant allele

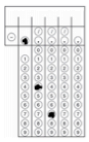
- Homozygous Recessive=q^2=24/87= .2758

$q^2=\sqrt{.2758}$

q=.5252

p+q=1

p=.47



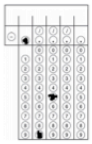
Q5: Rate

Hydrogen peroxide is broken down to water and oxygen by the enzyme catalase. The following data were taken over 5 minutes. What is the **rate** of enzymatic reaction in mL/min from 2 to 4 minutes? Round to the nearest hundreds

Time (mins)	Amount of O_2 produced (mL)
1	2.3
2	3.6
3	4.2
4	5.5
5	5.9

Q5

- Rise/run= rate= 5.5-3.6/4-2
- Rise/run= rate=1.9/2
- Rise/run= rate= .95



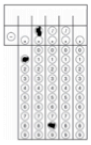
Q6: Laws of Probability

- Calculate the probability of tossing three coins simultaneously and obtaining three heads. Express in fraction form.

Q6

- Probability of a heads is ½
- Probability of heads AND a heads AND a heads

½ X ½ X ½=1/8



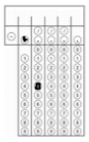
Q7: Population Growth

N—total number in pop r—rate of growth

- There are 2,000 mice living in a field. If 1,000 mice are born each month and 200 mice die each month, what is the **per capita growth rate** of mice over a month? Round to the nearest tenths.

Q7

- N=2000
- r_{max}=1000-200=800
- 800/2000= 0.4

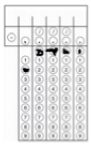


Q8

- The net annual primary productivity of a particular wetland ecosystem is found to be 8,000 kcal/m2. If respiration by the aquatic producers is 12,000 kcal/m2per year, what is the gross annual primary productivity for this ecosystem, in kcal/m2 per year? Round to the nearest whole number.

Q8

- NPP=GPP-R
- 8,000 = GPP – 12,000
- 8,000+ 12,000= GPP
- 20,000=GPP



Q9: Q_{10}

- Data taken to determine the effect of temperature on the rate of respiration in a goldfish is given in the table below. Calculate Q_{10} for this data. Round to the nearest whole number.

Temperature (C)	Respiration Rate (Minute)
16	16
21	22

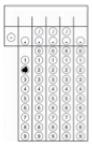
Q9

$$Q_{10} = \left(\frac{k_2}{k_1}\right)^{\frac{10}{t_2 - t_1}}$$

Q_{10}= (22 /16) $^{10/(21-16)}$

Q_{10}= (1.375) ^{2}

Q_{10}= 2



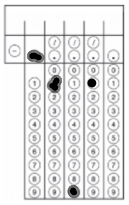
Q10:Standard Deviation

- Grasshoppers in Madagascar show variation in their back-leg length. Given the following data, determine the **standard deviation for this data.** Round the answer to the nearest hundredth.

Length(cm): 2.0, 2.2, 2.2, 2.1, 2.0, 2.4 and 2.5

Q10

- Average = 2.0 + 2.2 +2.2+2.1+2.0 +2.4 +2.5/7=2.2
- Dev = -.2+ 0+ 0+-.1+-.2+.2+.3
- Dev Squared = .04+0+0+.01+.04 +. 04+.09= .22
- **.22/7-1 = .0366**
- $\sqrt{.0366}$ **= .191**



Q11: Dilution

- Joe has a 2 g/L solution. He dilutes it and creates 3 L of a 1 g/L solution. How much of the original solution did he dilute? Round to the nearest tenths.

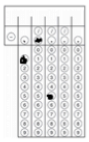
Q11

We are looking for V1:

C1V1 = C2V2

2V1 = 1(3)

V1= 1.5



Q12: log

- What is **the hydrogen ion** concentration of a solution of pH 8? Round to the nearest whole number

Q12

- [H+] if pH = 8.0
- $[H+] = 10^{-pH}$

  $[H+] = 10^{-8.0}$
- $1 \div 10^{8} = 0.00000001$

Math Review for AP Bio

Q13:
Initial mass of pumpkin cores was measured in grams. What is the **average** initial mass for the pumpkin cores? 29.15, 28.45, 30.92, 29.25, 32.09, 31.67.
Round to nearest hundredths.

Q13 Answer:

average initial mass = total mass/total number = 181.53/6 = 30.26 grams

Q14: $\chi^2 = \sum \frac{(o-e)^2}{e}$

In pea plants, smooth seeds are dominant to wrinkled, and purple flowers are dominant to white. In a dihybrid cross where a 9:3:3:1 ratio is expected, the following data was collected:

Smooth and Purple = 223
Smooth and White = 84
Wrinkled and Purple = 89
Wrinkled and White = 33

Determine the **chi-square value.** Round to nearest hundredths.

Q14 Answer:

Observed	Expected (9:3:3:1)
Smooth and Purple = 223	(9/16) 429 = 241
Smooth and White = 84	(3/16) 429 = 81
Wrinkled and Purple = 89	(3/16) 429 = 81
Wrinkled and White = 33	(1/16) 429 = 27
Total = 429	Total = 429

$$\chi^2 = \sum \frac{(o-e)^2}{e} = \frac{(241-223)^2}{241} + \frac{(81-84)^2}{81} + \frac{(81-89)^2}{81} + \frac{(27-33)^2}{27}$$
$$= 1.34 + 0.11 + 0.79 + 1.33 = \mathbf{3.57}$$

Q15: $\chi^2 = \sum \frac{(o-e)^2}{e}$

Two Wisconsin fast plants are crossed. One has the recessive dwarf trait, but the normal pigment anthocyanin, while the other has the recessive anthocyaninless trait, but is on normal height. Their offspring consist of:

89 plants of normal height and pigment
93 anthocyaninless plants and normal height
96 dwarf plants and normal pigment
94 anthocyaninless, dwarf plants

A student proposes that the parent plants' genotype must have been **ddAa** for the dwarf parent and **Ddaa** for the anthocyaninless parent. Calculate the **chi square value** that would be used to confirm this hypothesis. Round to nearest hundredths.

Q15 Answer:

ddAa x Ddaa = 1:1:1:1

Observed	Expected (1:1:1:1)
plants of normal height and pigment = 89	(1/4) 372 = 93
anthocyaninless plants and normal height = 93	(1/4) 372 = 93
dwarf plants and normal pigment = 96	(1/4) 372 = 93
anthocyaninless, dwarf plants = 94	(1/4) 372 = 93
Total = 372	Total = 372

$$\chi^2 = \sum \frac{(o-e)^2}{e} = \frac{(93-89)^2}{93} + \frac{(93-93)^2}{93} + \frac{(93-96)^2}{93} + \frac{(93-94)^2}{93}$$
$$= 0.17 + 0 + 0.10 + .01 = \mathbf{0.28}$$

Q16: p2 + 2pq + q2 = 1, p + q = 1

If 250 people out of a population of 1,000 are born with sickle-cell anemia, **how many** people in the population will be more resistant to malaria because they are heterozygous for the sickle-cell gene?

Q16 Answer:

$250/1000 = 0.25 = aa = q^2$
$q = 0.5, p = 1 - q = 0.5$
$2pq = 0.5$; **heterozygous = 0.5 x 1000 = 500**

Math Review for AP Bio

Q17: p2 + 2pq + q2 = 1, p + q = 1

In a population of 250 peas, 16% of the peas are homozygous recessive wrinkled and the rest are smooth. What is the frequency of the dominant allele for smooth peas?

Q17 Answer:

$16\% = 0.16 = ss = q^2$

$q = 0.4, p = 1 - q = \mathbf{0.6}$

Q18: p2 + 2pq + q2 = 1, p + q = 1

In a population that is Hardy-Weinberg equilibrium, the frequency of the homozygous recessive genotype is 0.09.

a. What is the p and q value for this population?
b. What is the frequency of individuals homozygous for the dominant trait?
c. What is the frequency of individuals that show the dominant trait?

Q18 Answer:

a) q = 0.3, p = 0.7 b) $p^2 = 0.49$ c) 2pq = 0.91

$0.09 = q^2$

a. $q = 0.3, p = 1 - q = 0.7$

b. $p^2 = 0.49$

c. $p^2 + 2pq = 1 - q^2 = 0.91$

Q19: *SA = l x w, V = l x w x h*

Four blocks of phenolphthalein agar are placed in a vinegar solution. The pH indicator solution changes to pink when in contact with an acidic solution.

Block A: 2 cm x 4 cm x 4 cm
Block B: 2 cm x 8 cm x 4 cm
Block C: 1 cm x 8 cm x 8 cm
Block D: 1 cm x 1 cm x 64 cm

a. Which block would the vinegar solution penetrate most thoroughly into after ten minutes?
b. Which block would have the greatest volume of pink phenolphthalein at the end of ten minutes?

Justify your answer mathematically and relate your predicted results to the **surface area** of your blocks.

Q19 Answer:

Four blocks of phenolphthalein agar are placed in a vinegar solution. The pH indicator solution changes to pink when in contact with an acidic solution.

	Surface area	Volume	SA/V
Block A: 2 cm x 4 cm x 4 cm	64	**32**	2
Block B: 2 cm x 8 cm x 4 cm	112	64	1.75
Block C: 1 cm x 8 cm x 8 cm	160	64	2.5
Block D: 1 cm x 1 cm x 64 cm	258	64	**4.03**

c. Which block would the vinegar solution penetrate most thoroughly into after ten minutes? **D, greater SA/V = faster diffusion**
d. Which block would have the greatest volume of pink phenolphthalein at the end of ten minutes? **A, smallest volume = more diffused inside**

Q20: total water potential = pressure potential + solute potential

$\psi_{total} = \psi_p + \psi_s$

Scientists are trying to determine under what conditions a plant can survive. They collect the following data and would like to know the water potential of the plant cell. The solute potential is -0.6 MPa and the pressure potential is -1.0 MPa. What is the **water potential**? Round to nearest hundredths.

Q20 Answer:

$\psi_{total} = \psi_p + \psi_s$

water potential $\psi_{total} = \psi_p + \psi_s$ = -0.6 MPa + -1.0 MPa = **-1.6 MPa**

Q21: growth rate = dN/dt = rN, r = b-d; $dN/dt = r_{max}N(1 - (N/K))$

A hypothetical population has a carrying capacity of 1,500 individuals and r_{max} is 1.0.

a. Fill out the following table:

Population size	**Population growth rate**
1,600	
1,750	
2,000	

b. What is happening to this population? Why?

Math Review for AP Bio

Q21 Answer:

logistic growth rate = dN/dt = rN, r = b-d; dN/dt = $r_{max}N(1 -(N/K))$

population number (N)
birth (b)
death (d)
carrying capacity (K)
rate (r)

at N = 1600: dN/dT = 1.0 x 1600 (1 - (1600/1500)) = 1600(1 - 1.06) = - 96

at N = 1750: dN/dT = 1.0 x 1750 (1 - (1750/1500)) = 1750(1 – 1.17) = - 298

at N = 2000: dN/dT = 1.0 x 2000 (1 - (2000/1500)) = 2000 (1 – 1.33) = - 660

Population size	Population growth rate
1,600	-96
1,750	- 298
2,000	- 660

shrinking because over carrying capacity

Q22: pH = -log [H+]

According to the Acid Rain Monitoring Project at the University of Mass, the pH measured at King Phillip Brook on April 10, 2012, was near 5, which the pH measured at Robbins Pond on that same date was near 9. Determine to the nearest whole number how many times greater the **hydrogen ion concentration** was at King Phillip Brook.

Q22 Answer:

pH 5: $[H+] = 1 \times 10^{-5}$
pH 9: $[H+] = 1 \times 10^{-9}$

$$\frac{1 \times 10^{-9}}{1 \times 10^{-5}} = \mathbf{10000}$$

Q23: growth rate = dN/dt = rN, r = b-d; dN/dt = (b-d)N

In 2009, the US had a population of about 307 million people. If there were 14 births and 8 deaths per 1000 people, what was the country's net **population growth** that year (ignore immigration and emigration)? Round to nearest thousandths.

Q23 Answer:
logistic growth rate = dN/dt = rN, r = b-d; dN/dt = (b-d)N

N = 307 million
b = 14/1000
d = 8/1000

dN/dt = (b-d)N = (14/1000 – 8/1000) 307 million = **1.842 million**