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# Math / Science Field Day

Scottsdale Community College

April 23, 1998

Final Round

# CHEM

10 pts

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- Which two variables are assumed to be constant in the derivation of Boyle's Law?
- temperature and moles of gas

# CHEM

20 pts

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- What is the molecular formula of buckminsterfullerene?
- $C_{60}$

# CHEM

30 pts

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- If manganic acid has the formula  $\text{HMnO}_3$ , then what is the formula for hypomanganous acid?
- $\text{HMnO}$

# CHEM

40 pts

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- How many electrons occupy the 3d subshell of a  ${}_{24}\text{Cr}$  atom in the ground state?
- 5

# CHEM

50 pts

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- What is the correct name of the complex:  $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$  ?
- tetraaquadichlorocobalt (III) chloride

# PHYSICS

10 pts

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- A 1200 kg truck, moving at a constant velocity, collides with and sticks to a 600 kg car initially at rest. If the velocity of the pair after the collision is 5 m/s what was the initial velocity of the truck before the collision ?
- 7.5 m/s

# PHYSICS

20 pts

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- Two masses  $M_1$  and  $M_2$  orbit the Earth. The mass of  $M_2 = 8000$  kg and orbits at a radius twice as that of  $M_1$ , as measured from the earth's center. If the force of gravity is the same on each mass, what is the mass of  $M_1$ ?
- 2000 kg

# PHYSICS

30 pts

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- Three equal light bulbs are connected in parallel to a battery. The equivalent resistance of all 3 is 3 ohms. The battery supplies 27 watts of power to the bulbs. What is the resistance of each bulb, and the battery voltage?
- 9 ohms , 9 volts

# PHYSICS

40 pts

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- A certain adjustable seesaw is 6 m long and has a mass of 100 kg. If a 50 kg boy wants to seesaw alone how far, in meters , from his end of the seesaw must he place the fulcrum.
- 2m

# PHYSICS

50 pts

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- Consider a small asteroid with a radius of  $R = 800$  m. The acceleration of gravity at its surface is  $g = 1 \text{ m/s}^2$ . Determine the minimum velocity, in meters per second, an object on the surface must achieve so as to never return again to the surface. Ignore any effects of nearby planets or stars
- 40 m/s

# BIO

10 pts

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- Autotrophic organisms acquire energy through which process?
- photosynthesis

# BIO

# 20 pts

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- What is the longest venomous reptile in AZ?
- Western diamondback rattlesnake

BIO

30 pts

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- Ammonifying bacteria play a role in which gaseous biogeochemical cycle?
- The Nitrogen Cycle

# BIO

# 40 pts

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- What are Urasauarus, Heloderma, and Sauromalus?
- lizards

# BIO

# 50 pts

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- Identify the process in which ATP is formed by the diffusion of hydrogen ions in the mitochondria.
- chemiosmosis