

ROUND 11

TOSS-UP

1) PHYSICS *Short Answer* In their studies of trans-uranium elements and crystallization studies of barium, Hahn and Meitner discovered what process?

ANSWER: FISSION (ACCEPT: NUCLEAR FISSION)

BONUS

1) PHYSICS *Short Answer* Assuming $g = -32 \text{ feet/sec}^2$ and friction is negligible, if a coffee bean is thrown upward from the top of a building with a vertical velocity of $+32 \text{ ft/sec}$, what will its velocity be in ft/sec after 3 seconds?

ANSWER: -64 (ACCEPT: -64 or 64 DOWN)

TOSS-UP

2) BIOLOGY *Short Answer* Afferent neuron is to sensory neuron as efferent neuron is to:

ANSWER: MOTOR NEURON

BONUS

2) BIOLOGY *Multiple Choice* Which of the following is most accurate about the pasteurization of milk:

- W) it heats milk to the boiling point for about 1 minute
- X) it kills all bacteria by passing steam through the milk
- Y) it kills most of the germs in the milk by moderate heating
- Z) it kills all the bacteria but not the viruses in the milk

ANSWER: Y) IT KILLS MOST OF THE GERMS IN THE MILK BY MODERATE HEATING

TOSS-UP

3) CHEMISTRY *Short Answer* Hydrocarbons that contain a carbon-carbon double bond are generally known as what:

ANSWER: ALKENES (ACCEPT: OLEFINS)

BONUS

3) CHEMISTRY *Short Answer* If you have 1 milliliter of a 75% ethanol stock solution, how much water, in milliliters, must be added to the 1 milliliter stock solution to obtain a 25% ethanol solution?

ANSWER: 2

(Solution: $75\%/25\% = 3df$; 1 part stock + 2 parts water = 3df)

TOSS-UP

4) ASTRONOMY *Short Answer* The total amount of energy of a star's surface radiated into space each second is most commonly referred to as what?

ANSWER: ABSOLUTE LUMINOSITY (ACCEPT: LUMINOSITY, INTRINSIC BRIGHTNESS, OR ABSOLUTE BRIGHTNESS)

BONUS

4) ASTRONOMY *Multiple Choice* If you could shrink the Earth to a quarter its present diameter while maintaining its mass, by what factor would the escape velocity change?

- W) the escape velocity would be doubled
- X) the escape velocity would be four times larger
- Y) the escape velocity would remain unchanged
- Z) the escape velocity would be reduced by half

ANSWER: W) THE ESCAPE VELOCITY WOULD BE DOUBLED

(Solution: escape velocity $\sim (M/R)^{1/2}$; $V_e = \sqrt{2GM/r}$)

TOSS-UP

5) MATH *Short Answer* What is the term for the part of the secant contained between the points of intersection on a curve?

ANSWER: CHORD

BONUS

5) MATH *Short Answer* Find the solution set of the following inequality: $x^2 - x - 2 \leq 0$

ANSWER: $-1 \leq x \leq 2$

TOSS-UP

6) EARTH SCIENCE *Multiple Choice* The Hawaiian Islands originated from magma:

- W) intruding along the boundary between two lithospheric plates
- X) formed within an island arc
- Y) injected along a mid-ocean fracture zone
- Z) coming from a hotspot within the mantle

ANSWER: Z) COMING FROM A HOTSPOT WITHIN THE MANTLE

BONUS

6) EARTH SCIENCE *Multiple Choice* Which of the following is classified as a silicate mineral:

- W) gypsum
- X) malachite
- Y) halite
- Z) quartz

ANSWER: Z) QUARTZ

TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* A severe and chronic deficiency in what vitamin causes the disease known as pellagra:

- W) vitamin C
- X) vitamin D
- Y) niacin
- Z) thiamine

ANSWER: Y) NIACIN

BONUS

7) GENERAL SCIENCE *Multiple Choice* What tree in the North-Central to Northeast US has heart-shaped leaves and a light-colored wood which is prized by wood carvers

- W) pin oak
- X) cottonwood
- Y) American sycamore
- Z) basswood

ANSWER: Z) BASSWOOD

TOSS-UP

8) COMPUTER SCIENCE *Multiple Choice* This distributed information system was prevalent in the years before the World Wide Web:

- W) Gopher
- X) SSL
- Y) LINUX
- Z) Fox

ANSWER: W) GOPHER

BONUS

8) COMPUTER SCIENCE *Multiple Choice* Dynamic RAM is called such because:

- W) the value it holds can be dynamically changed at any time
- X) the address space the RAM refers to can be dynamically changed
- Y) the value it holds must be dynamically refreshed every few milliseconds
- Z) the value it holds must be dynamically refreshed once a session

ANSWER: Y) THE VALUE IT HOLDS MUST BE DYNAMICALLY REFRESHED EVERY FEW MILLISECONDS

TOSS-UP

9) PHYSICS *Multiple Choice* Which of the following exhibits the least resistivity at 20°C:

- W) gold
- X) tungsten
- Y) iron
- Z) copper

ANSWER: Z) COPPER

BONUS

9) PHYSICS *Short Answer* If a violin string is 0.5 meters long and has a mass of 3.0 grams, what tension, in Newtons, must be on the string to give a wave velocity of 14.14 meters per second?

ANSWER: 1.2

(Solution: $V = \sqrt{\frac{T}{m/l}}$; $= m/l \times v^2 = T$; $(0.003/0.5)(200) = 1.2$ newtons)

TOSS-UP

10) BIOLOGY *Short Answer* The coronal suture is found between what two bones?

ANSWER: PARIETAL AND FRONTAL (accept in any order)

BONUS

10) BIOLOGY *Multiple Choice* Which of the following infectious agents is NOT properly matched with its disease:

- W) Trichophyton (read as: TRI-co-fie-ton) and ringworm
- X) Hepatitis A and serum hepatitis
- Y) Rubella and German measles
- Z) Epstein Barr and infectious mononucleosis

ANSWER: X) HEPATITIS A AND SERUM HEPATITIS

(Solution: Hepatitis A causes infectious hepatitis)

TOSS-UP

11) CHEMISTRY *Multiple Choice* Polystyrene is produced by which of the following reactions:

- W) free radical vinyl polymerization from the monomer styrene
- X) metallocene catalysis polymerization
- Y) graft copolymerization
- Z) butadiene polymerization

ANSWER: W) FREE RADICAL VINYL POLYMERIZATION FROM THE MONOMER STYRENE

BONUS

11) CHEMISTRY *Multiple Choice* Which of the following molecular shapes would you expect from O₃:

- W) bent
- X) trigonal planar
- Y) linear
- Z) see-saw

ANSWER: W) BENT

TOSS-UP

12) ASTRONOMY *Short Answer* When a one solar mass star becomes a red giant for the first time, its energy comes mainly from the fusion of helium forming into what final element?

ANSWER: CARBON

BONUS

12) ASTRONOMY *Multiple Choice* Which of the following distance-measuring techniques measures the farthest:

- W) radar ranging
- X) stellar parallax
- Y) variable stars
- Z) standard candle/Tully-Fisher relation

ANSWER: Z) STANDARD CANDLE/TULLY-FISHER RELATION

TOSS-UP

13) MATH *Multiple Choice* In a normal distribution, a mean of a sample population, plus or minus 1 standard deviation, includes what percentage of the sample:

- W) 16%
- X) 32%
- Y) 68%
- Z) 95%

ANSWER: Y) 68%

BONUS

13) MATH *Short Answer* What is the 13th term in the following arithmetic progression: 2, 7, 12...

ANSWER: 62

(Solution: $a_n = 2 + (13 - 1)5$)

TOSS-UP

14) EARTH SCIENCE *Multiple Choice* When two halves of a crystal aggregate are mirror images of each other and joined together in some definite, shared crystallographic orientation, such crystals are referred to as being:

- W) polymorphs
- X) symmetrical
- Y) twinned
- Z) anhedral

ANSWER: Y) TWINNED

BONUS

14) EARTH SCIENCE *Multiple Choice* Which of the following is FALSE about the Coriolis Effect:

- W) it is an apparent force due to the precession of the Earth
- X) it is an apparent force due to the rotation of the Earth
- Y) it causes winds in the Northern Hemisphere to be deflected to the right
- Z) it causes winds in the Southern Hemisphere to be deflected to the left

ANSWER: W) IT IS AN APPARENT FORCE DUE TO THE PRECESSION OF THE EARTH

TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* A wave with a wavelength of 40 meters and a height of 2 meters, will NOT be refracted in water with a depth of more than:

- W) 1 meter
- X) 2 meters
- Y) 10 meters
- Z) 20 meters

ANSWER: Z) 20 METERS

BONUS

15) GENERAL SCIENCE *Multiple Choice* The mass of a new 2002 USA quarter is about how many grams:

- W) 3.0
- X) 4.5
- Y) 5.5
- Z) 7.0

ANSWER: Y) 5.5

TOSS-UP

16) COMPUTER SCIENCE *Multiple Choice* Which printer uses bits of plastic that effectively are melted onto the surface of the paper:

- W) thermal
- X) ink jet
- Y) laser
- Z) dot matrix

ANSWER: Y) LASER

BONUS

16) COMPUTER SCIENCE *Multiple Choice* Which of the following is true for a binary tree but not for a regular tree:

- W) it stores only zeros and ones
- X) each parent node has no more than two children
- Y) its branches are ordered
- Z) nodes without children are called leaves

ANSWER: X) EACH PARENT NODE HAS NO MORE THAN TWO CHILDREN

TOSS-UP

17) PHYSICS *Multiple Choice* Red light has a wavelength of:

- W) 300-350 nanometers
- X) 450-500 nanometers
- Y) 550-600 nanometers
- Z) 650-700 nanometers

ANSWER: Z) 650-700 NANOMETERS

BONUS

17) PHYSICS *Short Answer* Bose-Einstein condensates were initially created by using elements from what specific part of the periodic table:

ANSWER: GROUP 1 (ACCEPT: ALKALI METALS)

TOSS-UP

18) BIOLOGY *Short Answer* From what vitamin is NAD derived?

ANSWER: NIACIN

BONUS

18) BIOLOGY *Short Answer* *Penicillium notatum* is to penicillin as *Bacillus subtilis* (pronounced: SUT-ill-iss) is to:

ANSWER: BACITRACIN

TOSS-UP

19) CHEMISTRY *Multiple Choice* Which of the following radioactive isotopes emits alpha particles:

- W) hydrogen-3
- X) cobalt-60
- Y) carbon-14
- Z) radium-226

ANSWER: Z) RADIUM-226

BONUS

19) CHEMISTRY *Short Answer* What is the molecular formula for the conjugate acid of the following Brønsted-Lowry base: HCO_3^-

ANSWER: H_2CO_3

TOSS-UP

20) ASTRONOMY *Short Answer* In North America, what is typically the most spectacular meteor shower in the month of August?

ANSWER: PERSEIDS

BONUS

20) ASTRONOMY *Multiple Choice* A bolometer (pronounced: bowl-O-meter) is used to:

- W) measure the energy output of the Sun
- X) measure the length of a bowling alley
- Y) measure the size of celestial bodies
- Z) standardize the azimuth of a sextant

ANSWER: W) MEASURE THE ENERGY OUTPUT OF THE SUN

TOSS-UP

21) EARTH SCIENCE *Multiple Choice* As the intensity of metamorphism increases, which of the following transformations occurs:

- W) granite to slate
- X) schist to slate
- Y) gneiss to quartzite
- Z) limestone to marble

ANSWER: Z) LIMESTONE TO MARBLE

BONUS

21) EARTH SCIENCE *Multiple Choice* In which of the following latitudes would you expect belts of high pressure to typically develop:

- W) 30° North
- X) 0°
- Y) 50° North
- Z) 60° South

ANSWER: W) 30° NORTH

TOSS-UP

22) GENERAL SCIENCE *Multiple Choice* Which of the following is classified as a water-insoluble fiber:

- W) algal polysaccharides
- X) pectin
- Y) lignin
- Z) gums

ANSWER: Y) LIGNIN

BONUS

22) GENERAL SCIENCE *Short Answer* Methods that cause hair to have curls usually rely on manipulating disulfide bonds in what amino acid?

ANSWER: CYSTINE

TOSS-UP

23) PHYSICS *Multiple Choice* The line spectra of low density gases is usually produced by the emission or absorption of light by:

- W) molecules
- X) crystals
- Y) crystal lattices
- Z) individual atoms

ANSWER: Z) INDIVIDUAL ATOMS

BONUS

23) PHYSICS *Short Answer* What was the last name of the father and son team that developed the theory and technique of X-ray diffraction by crystals?

ANSWER: BRAGG

TOSS-UP

24) BIOLOGY *Short Answer* Avery and Macleod attributed the transforming principle to what substance?

ANSWER: DNA

BONUS

24) BIOLOGY *Short Answer* What other vitamin acts like an antagonist and has the most similar structure to vitamin K?

ANSWER: VITAMIN E

(Solution: both are isoprenoids)

TOSS-UP

25) CHEMISTRY *Multiple Choice* Reaction with a copper compound is a qualitative test for which functional group:

- W) alcohol
- X) aldehyde
- Y) ketone
- Z) carboxylic acid

ANSWER: X) ALDEHYDE

BONUS

25) CHEMISTRY *Short Answer* Name the two elements that have atomic numbers less than that of lead that have no stable isotopes:

ANSWER: TECHNETIUM AND PROMETHIUM (ACCEPT: Tc and Pm)