TOSS-UP

1. PHYSICS *Short Answer*- What is the name of the dimensionless factor, abbreviated RN, that determines the onset of turbulence in a tube?

ANSWER: REYNOLDS NUMBER

BONUS

PHYSICS *Short Answer*- Denote by name or number all of the following four statements that is or are true about the Reynolds number?

1: If RN is below 2000, then the flow of the fluid through the tube is turbulent

2: If RN is above 2000, then the flow of the fluid through the tube is turbulent

3: If RN is above 3000, then the flow of the fluid through the tube is turbulent

4: If RN is between 2000 and 3000, then the flow of the fluid through the tube is neither streamline nor turbulent

ANSWER: 3 AND 4

TOSS-UP

1. BIOLOGY *Short Answer*- What is the name of proteins that infected cells release in order to stimulate neighboring cells to take safety measures, such as producing substances that limit viral reproduction?

ANSWER: INTERERONS

BONUS

BIOLOGY *Multiple Choice*- Which of the following statements about the immune system is true?

W) Class II major histocompatibility complexes are produced on the surfaces of only a few cell types, such as macrophages and B cells

X) Class II major histocompatibility complexes are recognized by cytotoxic T cells

Y) Cytotoxic T cells release granzymes, which form pores on the target cell’s membrane

Z) Class I major histocompatibility complexes are found on red blood cells

ANSWER: W

TOSS-UP

1. MATH *Short Answer*- At what point is the equation f(x) = 8x – 5 and g(x) = x2+ 7x + 9 tangent? There is only one answer.

ANSWER: (1,3)

BONUS

MATH *Multiple Choice*- The equation f(x) = x3 + 6x2 + kx + m is tangent to g(x) = 2x2 + x at the point (1,3). What is k + m?

W) -7

X) -4

Y) -1

Z) 2

ANSWER: X

TOSS-UP

1. CHEMISTRY *Short Answer*- Denote all of the following three statements that are true about amino acids.

1: In an alkaline solution, the carboxyl group is ionized and the amino group unionized

2: Only L-amino acids are constituents of proteins

3: In an acidic solution, both the carboxyl group and the amino group is ionized

ANSWER: 1 AND 2

BONUS

CHEMISTRY *Multiple Choice*- Which of the following is another name for a dipolar ion form of an amino acid?

W) Zingibrion form

X) Zimmerion form

Y) Zymotrion form

Z) Zwitterion form

ANSWER: Z

TOSS-UP

1. EARTH AND SPACE SCIENCE *Short Answer*- Denote all of the following three statements that are drawbacks of radio telescopes.

1: Radio telescopes cannot catch a lot of radiation due to their small size

2: Radio telescopes cannot observe during the night

3: The resolution of radio telescopes is extremely poor

ANSWER: 3

BONUS

EARTH AND SPACE SCIENCE *Multiple Choice*- Which of the following four telescopes is the current functional x-ray telescope, launched in 1990 as a joint effort of the United States, Germany, and the United Kingdom?

W) Einstein Observatory

X) Gamma Ray Observatory

Y) Roentgen Satellite

Z) International X-ray Explorer

ANSWER: Y

TOSS-UP

1. PHYSICS *Short Answer*- What is the name of the constant of proportionality used to calculate the tensile strain and stress on a material?

ANSWER: YOUNG’S MODULUS

BONUS

PHYSICS *Multiple Choice*- Which of the following four statements is true about elasticity?

W) Mercury’s Young’s modulus is 1.2 X 107 pascals

X) The value of the Young’s modulus changes depending on whether the substance is compressed or stretched

Y) The change in length of a substance by a force does not depend on the original size

Z) The greatest stress a substance can withstand without breaking is called the decisive strength

ANSWER: X

TOSS-UP

1. BIOLOGY *Short Answer*- Pseudohypertrophic muscular dystrophy is sex-linked and leads to death in the early teens. Denote all of the following four statements that are true.

1: The disease is caused by a dominant allele

2: The disease is caused by a recessive allele

3: Girls commonly do not receive this disease

4: The disease’s inheritance is autosomal

ANSWER: 2 AND 3

BONUS

BIOLOGY *Short Answer*- Denote all of the following four diseases that are caused by prions?

1: Cadang-cadang

2: Creutzfeldt-Jakob disease

3: Phalaropes disease

4: Scrapie

ANSWER: 2 AND 4

TOSS-UP

1. MATH *Short Answer*- A square with coordinates of (0,1), (5,1), (5,4), and (0,4) is rotated around the y-axis. What is the total volume, in terms of π?

ANSWER: 75π

BONUS

MATH *Short Answer*- What is the result when 12/99 is added to 400/999? Express your answer as a fraction.

ANSWER: 521612/999999

TOSS-UP

1. CHEMISTRY *Multiple Choice*- Which of the following is the correct form of the radial distribution function?

W) P(r) = rR(r)

X) P(r) = r / R(r)

Y) P(r) = r2R2(r)

Z) P(r) = r2R(r)

ANSWER: Y

BONUS

CHEMISTRY *Short Answer*- At what value of r is the value of P at its maximum?

ANSWER: BOHR RADIUS

TOSS-UP

1. EARTH AND SPACE SCIENCE *Short Answer*- Denote all of the following three statements that are true.

1: Larger seamounts are called guyots

2: Open-ocean sediments are called limnotic sediments

3: Abyssal hills are typically perpendicular to the ridge crest

ANSWER: 1

BONUS

EARTH AND SPACE SCIENCE­ *Short Answer*- What is the name of the phenomenon when the particles of the shells of foraminifers accumulate on the bottom of the ocean?

ANSWER: FORAMINIFERAL OOZE

TOSS-UP

1. BIOLOGY *Multiple Choice*- Which of the following is a bulk feeder?

W) Mosquito

X) Whales

Y) Caterpillars

Z) Humans

ANSWER: Z

BONUS

BIOLOGY *Short Answer*- What is created when fats are coated with phospholipids, cholesterol, and proteins in order to allow fats to pass into the lacteal?

ANSWER: CHYLOMICRONS