English for special purposes, bunch 1 **1393/01/20**

1 Which of the following is correct?

a A diamond is necessarily a parallelogram.

b A diamond is necessarily a rectangle.

c A diamond is necessarily a square.

d A diamond is necessarily a triangle.

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2 Which of the following exists?

a the smallest positive real number

b the smallest positive rational number

c the smallest positive irrational number

d the smallest positive integer

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3 The volume fraction of carbon dioxide in the atmosphere of the earth used to be about 0.03% before the industrial revolution. It is now around 0.04%. The molecular mass of carbon dioxide is 44 amu, while that of the atmospheric air is 29 amu. Which of the following is closer to the today's value of the *mass* fraction of carbon dioxide in the atmosphere of the earth?

a 0.03%

b 0.04%

c 0.05%

d 0.06%

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4 When a warm-blooded animal is at rest, it still needs to consume energy, mostly to maintain its body temperature. This is in contrast with the case of cold-blooded animals, for which the body temperature varies with the temperature of the surrounding. That the temperature of the warm-blooded animals

is more or less constant, makes them agile even when the surrounding is cold, but the price is that they need to consume energy to keep their body temperature fixed. Comparing a warm-blooded animal, say a cat, and a cold-blooded one, say a snake, provided their masses are comparable to each other, which do you think needs more food?

a always the cat

b always the snake

c during cold times the cat

d during cold times the snake

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5 The energy which a warm-blooded animal consumes while resting, is mostly dissipated in the form of heat. The heat current is proportional to the surface area of the animal's skin, which in turn is proportional to the square of the linear scale of the animal. The mass of the animal is proportional to the cube of its linear scale. Let us neglect other forms of energy exchange. The power produced inside the body of a warm-blooded animal is proportional to its linear scale to some power α. Based on the above arguments, what is the value of α?

a 1 **b** 2 **c** 3 **d** 4

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6 Continuing the previous problem, the power per mass, produced inside the body of a warm-blooded animal is proportional to its mass to some power β. Based on the above arguments, what is the value of β?

a $-\frac{1}{3}$ **b** $-\frac{1}{2}$ **c** $\frac{1}{2}$ **d** $\frac{1}{3}$

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7 Still continuing, let us assume that the typical life time of a warm-blooded animal is inversely proportional to the power per mass, produced inside the body of the animal. Then the typical life time of a warm-blooded animal is proportional to its mass to some power γ. Based on the above arguments, what is the value of γ?

a $-\frac{1}{3}$ **b** $-\frac{1}{2}$ **c** $\frac{1}{2}$ **d** $\frac{1}{3}$

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8 In early universe, after the quarks had been hadronized in protons and neutrons, the neutrons combined with protons to produce Helium nuclei. So after that event, the universe consisted of essentially only Hydrogen and Helium nuclei, which were subsequently recombined with electrons to produce neutral Hydrogen and Helium atoms, roughly 75% Hydrogen and 25% percent Helium. This was before any star had been born. Inside a star, hydrogen nuclei combine to produce Helium nuclei. Based on these, what do you expect the fraction of hydrogen in a star should be?

a 100%

b between 100% and 75%

c 75%

d less than 75%

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9 Unstable nuclei decay towards stable nuclei. There are a variety of ways for the unstable nuclei to move towards stability, three ways are more common for naturally occurring unstable nuclei. These are alpha- beta- and gamma-decays. In an alpha decay, the nucleus looses an alpha particle, a Helium-4 nuclei. In beta decay, the nucleus looses an electron (as well as an anti-neutrino). In gamma decay, the nucleus emits a high energy photon. Of these three kinds of decay, it is only alpha decay which results in a change in the mass number of the nucleus: it reduced the mass number by 4. A uranium-235 nucleus (235 is its mass number) decays and produces a lead nucleus. Which of the following could be the mass number of the resulted lead nucleus?

a 204 **b** 206 **c** 207 **d** 208

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10 The intensity of a light source at a certain point is the power which passes through unit area perpendicular to the light (of

the source). Comparing the moon and Sirius, the brightest star of the sky (not counting the sun, of course), which is correct?

a The power of the moon is larger.

b The intensity of the moon is larger.

c The moon is farther.

d The moon is hotter.

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11 A light year is the distance traveled by light in vacuum during one year. The light year is a unit for a quantity. What quantity?

a time **b** length **c** mass **d** energy

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12 The gallon is a unit of volume. It is not an SI unit, and there are at least two versions for gallon. The US gallon is slightly less than 4 liters, while the imperial gallon is slightly more than 4 liters. In addition to these, yet a third gallon is defined which is called the metric gallon. It is by definition exactly equal to 4 liters. Some other related units are the quart, which is one fourth of the gallon, the pint, which is one half the quart, and the cup, which is one half the pint. How many cubic centimeters is a metric cup?

a 100 **b** 200 **c** 250 **d** 400

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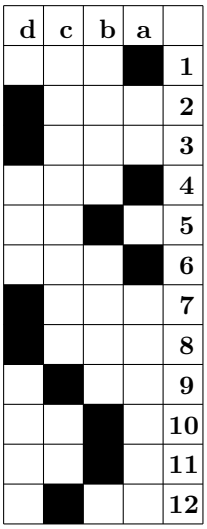
13 Good luck!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