1 Kepler's third law states that for objects revolving the sun, the square of the period of the revolution divided by the cube of the semi-major axis of the orbit is constant. If the period of something is 76 years, what would be the semi major axis of its orbit, in terms of the astronomical unit?

a 9 **b** 18 **c** 76 **d** 5000

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2 When a neuron is at rest, its walls let only potassium ions go in or out. The concentration of the potassium ions is much larger inside. When the concentration of something is not uniform and that thing can move freely, a current flows from the concentrated points to the less concentrated points. Potassium ions are positively charged. If there is an unbalance of the charges, an electric potential difference is created, so that the potential is larger where there are positive charges. The electric potential of the inside of a neuron minus the electric potential outside, when the neuron is at rest, is

a positive **b** negative **c** zero

d sometimes positive and sometimes negative

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3 The amount of energy received by a planet is inversely proportional to the square of the distance of the planet from the sun. The amount of energy given off by the planet is proportional to the forth power of its surface temperature. Assuming that no energy is produced within the planet, and assuming no atmosphere for the planet, the surface temperature of a planet is proportional to its distance to the sun, to the power α. What is the value of α?

a -1 **b** $-\frac{1}{2}$ **c** $-\frac{1}{4}$ **d** 0

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4 The volume rate of a fluid current is equal to the speed of flow times the area of the cross section. For an incompressible flow (like water) and when the steady state is achieved, this rate is the same for all cross sections. For a flow of water coming down from a tap, the speed is proportional to the square root of the height it has dropped from the tap. The cross section of the flow is a disk. When the steady state has been achieved, The radius of the cross section is proportional to the height the water has to fall from the tap to reach that cross section, to the power β. What is the value of β?

a -1 **b** $-\frac{1}{2}$ **c** $-\frac{1}{4}$ **d** 0

---

5 An adult human needs about 10 MJ energy per day in order to live (without hard work). The energy content of fats, carbohydrates, and proteins are estimated as 9, 4, and 4 kcal per gram, respectively. How many typical ice creams per day is enough to sustain an adult?

a 0.5 **b** 5 **c** 50 **d** 500

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6 One way to express the thickness of a piece of paper is in terms of a mass. An 80-gram paper, is a paper of such a thickness that 1 square meter of that has a mass of 80 gram. An A0 paper has a surface area of 1 square meter. An A$(n+1)$ paper has a surface area equal to half the surface area of an An paper. What is the mass of an 80-gram A4 paper, in terms of gram?

a 1 **b** 5 **c** 20 **d** 80

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7 What is the thickness of an 80-gram A4 paper, in terms of mm?

a 1 **b** 0.1 **c** 0.01 **d** 0.001

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8 The size of a typical human cell is of the order of 10 μm. How many cells do you have?

a 10^{23} **b** 10^{20} **c** 10^{17} **d** 10^{14}

9 The speed is defined as the length of the velocity vector. For a particle moving on a curve which is not a straight line,

a it is possible that the velocity be a nonzero constant.

b it is possible that acceleration be zero while the speed is nonzero.

c the acceleration is always parallel to the velocity.

d it is possible that the acceleration be normal to the velocity.

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10 A plane is flying at a ground speed of 1000 km/h, along a parallel of the earth, westward. What is the latitude of that parallel, if the sun is constant with respect to the plane?

a 23° **b** 45° **c** 53° **d** 67°

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11 At the equator, on equinox, the sun rises and sets vertically (with respect to the horizon). The angular size of the Sun is half a degree. Then and there, at sunrise how many minutes it takes between the time the top of the sun touches the horizon and the time its bottom leaves the horizon?

a 0.5 **b** 2 **c** 10 **d** 30

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12 What is the acceleration of the earth (with respect to the sun), in terms of meter per square second?

a 6×10^{-3} **b** 0.1 **c** 2 **d** 100

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13 Good luck!

English for special purposes, bunch 3 **1394/03/11**

Please mark the correct answers in the answer sheet (the table below) and return it. In case some data is missing, find it.

Name: Mohammad Khorrami
Student number: 0

	a	b	c	d
1		■		
2		■		
3		■		
4			■	
5		■		
6		■		
7		■		
8				■
9				■
10			■	
11		■		
12	■			