International Junior Science Olympiad

BALI - INDONESIA, 2nd - 11th December 2016
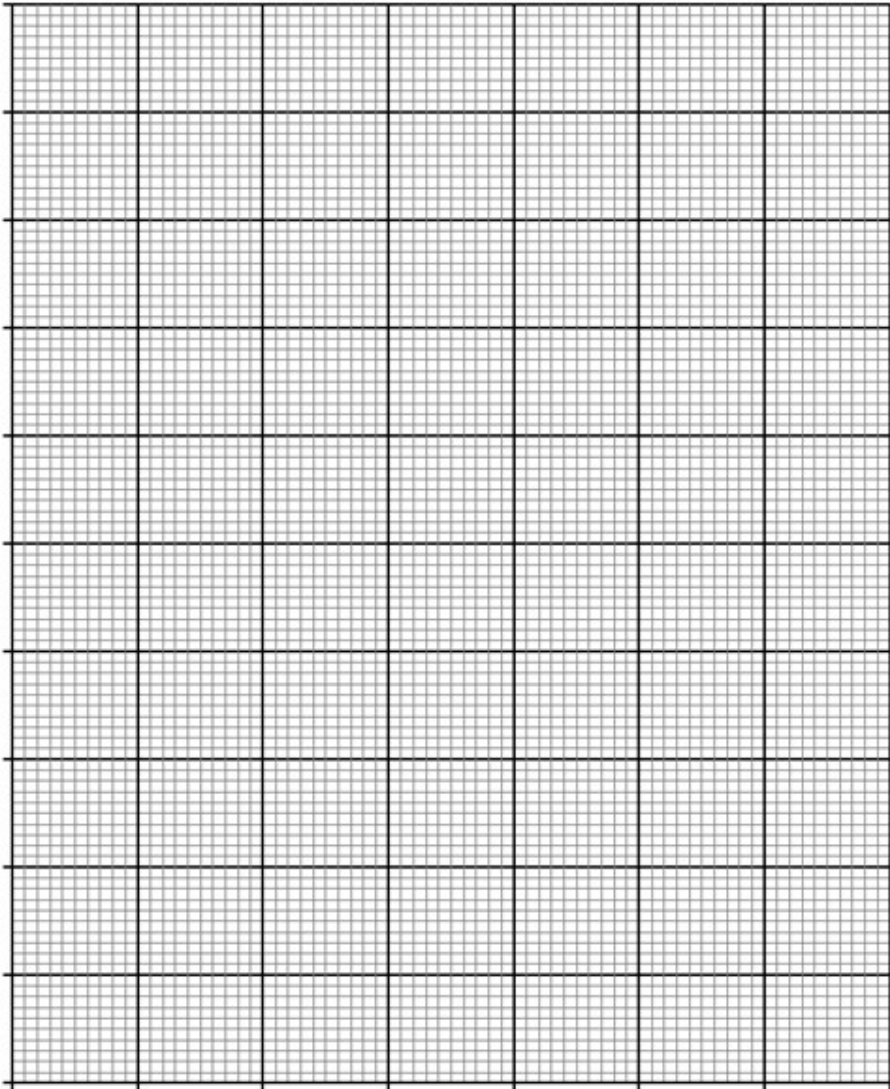
Science for Creative Innovation

EXPERIMENT COMPETITION

DECEMBER, 8th 2016

ANSWER SHEET

	Country	
	Student 1	Student 2	Student 3
Name			
Team Code			
Signature			

PART ONE: Physics, The effectiveness of energy absorption by water [13.0 points]

Data

t(min)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
T (°C)									
t(min)	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5
T (°C)									
t(min)	9.0	9.5	10.0	10.5	11.0	11.5	12.0		
T (°C)									

Question (Points)	Make a graph of the temperature (°C) of water as a function of time (in minute).
Ph-1 (3.0)	

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Question (Points)	Determine the linear range of watertemperature change (ΔT) and time change (Δt).
Ph-2 (1.5)	

Question (Points)	Calculate the rate of water temperature change (in °C/s) with respect to time by using the linear part of the graph(which means linear process in water).
Ph-3 (2.0)	

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Question (Points)	Calculate how much electrical energy (in joule) is used within the linear part of the graph (electric power used by the stove is 600W).
Ph-4) (2.0)	

Question (Points)	Calculate how much heat (in joules) is used to increase the temperature of the water in thelinear part of the graph. (Note that c_{water} = 4180 J/kg.°C and ρ = 1000 kg/m³).
Ph-5 (1.5)	

Question (Points)	Calculate how much heat (in joule) is released into the environment within the linear part of the graph.
Ph-6 (1.5)	

Question (Points)	Calculate the percentage of energy used to raise the temperature of water with respect to the total energy of the stove within the linear part of the graph.
Ph-7 (1.5)	

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Total points for PART ONE	

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PART TWO: Biology, Characteristics of Nutmeg [13.0 points]

A. Nutmeg Fruit

Question (Points)	Bi-1. Draw the longitudinal section of the fruit with the seed intact. Bi-2. Label parts of the fruit with reference provided on the answers box. Show the fruit parts by arrows. Choose the corresponding parts from the answers box and write down the answer by writing the letter only (for example A, B, C etc.).
Bi-1 (2.0) Bi-2 (3.0)	

B. Nutmeg Seed

Question (Points)	Bi-3. Draw the cross section of the seed. Bi-4. Label parts of the seed with reference provided on the answers box. Show the seed parts by arrows. Choose the corresponding parts from the answers box and write down the answer by writing the letter only (for example A, B, C etc.)
Bi-3 (3.0) Bi-4 (2.0)	

C. Nutmeg Fruit and Seed Characteristics

Question (Points)	Tick (√) one correct answer on each classification categories (A-F) in the box provided below.			
Bi-5 (3.0)	A. Fruit origin:	☐ Simple fruit	☐ Compound fruit	
	B. Fruit composition:	☐ True fruit	☐ Accessory fruit	
	C. Fruit description:	☐ Fleshy fruit	☐ Dry fruit	
	D. Fruit type:	☐ Pome	☐ Drupe	
	E. Seed cotyledon:	☐ Monocotyledon	☐ Dicotyledon	
	F. Seed shape:	☐ Round	☐ Ovoid	

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Total points for PART TWO	

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PART THREE: Chemistry, Nutmeg Oil Distillation [14.0 points]

After conducting experiment by using 120 g of ground nutmeg seed, you have obtained certain amount of nutmeg oil.

Question (Points)	How much is the volume of nutmeg oil you have obtained?
Ch-1 (4.50)	

Question (Points)	It is known that the mass of exactly 1.00 mL of nutmeg oil is 0.862 g at 25 °C. What is the percentage by mass of nutmeg oil in nutmeg seed according to your experiment if it is measured at 25 °C?
Ch-2 (1.50)	

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Question (Points)	It is known that the main component of nutmeg oil is myristicin. Assume that your sample of nutmeg oil contains 65% of myristicin ($C_{11}H_{12}O_3$) by mass. **(a) [1.5 point]** Calculate the number of myristicin molecules in your sample. **(b) [1.5 point]** Calculate the mass of the carbon in grams in the myristicin in your sample. (atomic mass of C = 12, H = 1, and O = 16)
Ch-3 (3.00)	

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Question (Points)	Based on the result of your experiment, calculate how many kilograms of nutmeg seed powder are required to produce 100 grams of nutmeg oil?
Ch-4 (1.00)	

Question (Points)	What is the function of boiling stones added in your experiment? (a) to accelerate the heating of water (b) to speed up the separation of nutmeg oil from water (c) to assist the distribution of heat inside the cylindrical flask content.
Ch-5 (0.50)	Choose one correct answer by putting an X in one of the boxes below. (a)　　(b)　　(c)

Question (Points)	What is the main aim of using nutmeg seed powder rather than nutmeg seed granules in your experiment? (a) to increase the solubility of nutmeg seed in water (b) to increase the contact surface of nutmeg seed and water (c) to speed up the evaporation of water in the flask.
Ch-6 (0.50)	Choose one correct answer by putting an X in one of the boxes below. (a) (b) (c)

Question (Points)	The separation of water and nutmeg oil in the Dean-Stark apparatus reflects the principle of .... (a) like dissolves like (b) vapor pressure difference (c) chemical equilibrium.
Ch-7 (0.75)	Choose one correct answer by putting an X in one of the boxes below. (a) (b) (c)

Question (Points)	If the flow of cooling water in your experiment is changed from upper to lower part of the condensor, the condensation of the steam and nutmeg oil will be .... (a) more effective (b) less effective (c) no effect.
Ch-8 (0.75)	Choose one correct answer by putting an X in one of the boxes below. (a) (b) (c)

Question (Points)	Which of these following alternative separation techniques can be used to obtain nutmeg oil from the seed of nutmeg (a) Centrifugation (b) Solvent extraction (c) Paper chromatography
Ch-9 (0.75)	Choose one correct answer by putting an X in one of the boxes below. (a) (b) (c)

Question (Points)	What kind of changes in the experimental design would not reduce the yield of nutmeg oil (a) Heating too rapidly (b) Using more boiling stones (c) Using too short water condensor

Ch-10 (0.75)	Choose one correct answer by putting an X in one of the boxes below.
	
	    ☐ ☐ ☐
	
	   (a) (b) (c)

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Total points for PART THREE	

PART ONE	
PART TWO	
PART THREE	
Total Points of Experiment Competition	