



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015**

COURSE NAME : ENVIRONMENTAL PHYSICS
COURSE CODE : BWC 30603
PROGRAMME : 3 BWC
EXAMINATION DATE : DECEMBER 2014 / JANUARY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

- Q1** The environment may be defined as the medium in which any entity finds itself. For example, for a cloud, its environment may be the region of the atmosphere in which it is formed, while for a plant, it is the field in which it lies, and for a whale it is the sea in which it swims. Discuss the environmental issues within the context of the human, building and global surroundings. This discussion must include the introduction, content and conclusion. (20 marks)
- Q2** The 500 kg iron block shown in Figure **Q2** is initially at 200 °C and is allowed to cool to 27 °C by transferring heat to the surrounding air at 27 °C. At this temperature, the iron block is used to maintain a house when the outdoor temperature is 5 °C. Analyze the maximum amount of heat that can be supplied to the house as the iron cools to 27 °C. (Hint: reversible work, irreversibility, COP , Q_L) (20 marks)
- Q3** (a) Create your idea about the renewable energy that can be used for your building to reduce the electricity costs. (5 marks)
- (b) In evaluating the energy implications of the choice between reusable and single use cups, the energy required in heating wash water is a key parameter. Consider a comparison between single-use polypropylene (PP) and reusable PP cups. The reusable cup has a mass roughly 14 times the single use cup (45 g vs 3.2 g), which, in turn requires petroleum feedstocks. C_p of water = 4.184 J/g K.
- (i) Calculate the number of times the reusable cup must be used in order to recoup the energy in the petroleum required to make the reusable cup. (2 marks)
- (ii) Assuming that the reusable cup is washed after each use in 0.27 liters of water, and that the wash water is 80 °C (heated from 20 °C), calculate the energy used in each wash if the water is heated in a gas water heater with 80% efficiency. Calculate the number of times the reusable cup must be used in order to recoup both the energy required to make the reusable cup and the energy used to heat the wash water. Assume that 1.2 kg of petroleum is required to produce 1 kg of polypropylene and that the energy of combustion of petroleum is 44 MJ/kg. (10 marks)
- (iii) Repeat Q3(b)(ii) assuming that an electric water heater is used (80% efficiency) and that electricity is generated at from fuel at 33% efficiency. (3 marks)

- Q4** (a) Define the following terms:
- (i) Thermal conductivity (2 marks)
 - (ii) Thermal resistivity (2 marks)
 - (iii) Thermal conductance (2 marks)
- (b) Three kind of insulator material A, B and C with a similar thickness have a thermal resistance value, R as tabulated in Table **Q4(b)**.

Table Q4(b): R value per cm for material A, B and C

R value per cm		
A	B	C
5.0	7.0	6.3

Referring to Table **Q4(b)**;

- (i) Construct a sequence order of these materials from lower to higher quality of insulator properties. (2 marks)
 - (ii) Justify your answer in Q4(b)(i). (4 marks)
- (c) One wall of a house consists of plywood backed by insulation. The thermal conductivities of the insulation and plywood are, $0.030 \text{ Wm}^{-1}\text{K}^{-1}$ and $0.080 \text{ Wm}^{-1}\text{K}^{-1}$ respectively, and the area of the wall is 35 m^2 as illustrated in Figure **Q4(c)**. Calculate,
- (i) the temperature at the interface, T . (4 marks)
 - (ii) the amount of heat conducted through the wall in one hour. (4 marks)
- Q5** (a) (i) Solar technology techniques can be divided into two categories. Explain each of the categories. (2 marks)
- (ii) The atmosphere is divided into four structures. Categorise the structure and explain each of it in terms of the altitude. (4 marks)

- (b) The existence of the Greenhouse Effect (GE) was argued for by Joseph Fourier in 1824. The argument and the evidence were further strengthened by Claude Pouillet in 1827 and 1838.
- (i) What is a Greenhouse Effect?
(2 marks)
- (ii) Explain in detail GE mechanism in the atmosphere and the effect to the climate change.
(4 marks)
- (iii) Predict the greenhouse gases that affect the global warming.
(4 marks)
- (c) Assume that the sun is a sphere of radius 6.96×10^8 m and that its surface temperature is 5.8×10^3 K. If the sun radiates at a rate of 3.90×10^{26} W and is a perfect emitter, at what rate is energy emitted per square meter at the sun's surface? Given: Stefan-Boltzmann constant = $\sigma = 5.67 \times 10^{-8} \text{ J}/(\text{s} \cdot \text{m}^2 \cdot \text{K}^4)$
(6 marks)

- Q6** (a) (i) What is a nuclear reactor?
(2 marks)
- (ii) Nuclear reactors are categorized by several methods. Classify the reactor by type of the nuclear reaction and explain in detail each of the reactor classifications.
(4 marks)
- (iii) Distinguish between pressurized water reactor (PWR) and boiling water reactor (BWR).
(4 marks)
- (b) A catastrophic nuclear accident occurred at Chernobyl, Russia on 26 April 1986. An explosion and fire released large quantities of radioactive particles into the atmosphere, which spread over much of the western Russia and Europe.
- (i) Analyze the causes of this accident and the effect to environment and ecosystem.
(4 marks)
- (ii) Propose your idea about the safety of nuclear reactor to avoid this accident occurred again.
(6 marks)

-END OF THE QUESTION-

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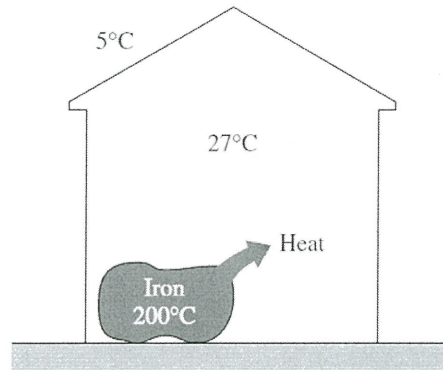


FIGURE Q2

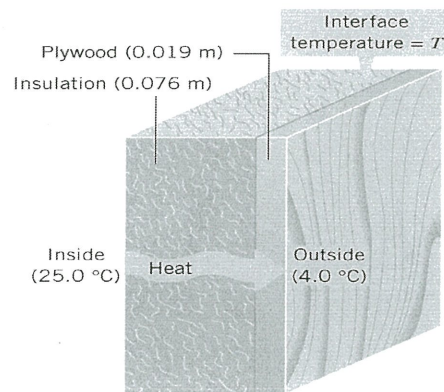


FIGURE Q4(c)