**Phys11 Nuclear Physics, Investigation 2 : Nuclear Reactors and Applications: Validation Test**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Mark: Test \_\_\_\_\_\_\_/22\_\_Notes \_\_\_/7 Total \_\_\_\_\_\_/29

Notes: Q1\_\_/2;Q2\_\_\_/3; Q 3\_\_\_/1; Q4 \_\_\_/1; Q5 \_\_\_/2

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| **1** | In a nuclear reaction, neutrons are produced. Which statements are correct in a nuclear reactor.  (i)The moderator reduces the number of neutrons.  (ii) The control rods act as a neutron poison.  (iii) Uranium 238 produces neutrons in the fission reaction.  (iv) Deuterium reduces the speed of the neutrons.   1. (ii) and (iii) 2. (i), (ii) and (iv) 3. (ii) and (iii) 4. (i) and (iv) | (2)  b |
| **2** | a) Write a reaction for nuclear fission?  10n + 23592U → 23692U\*  23692U\* → 9236Kr + 14156Ba + 3 10n  b) Explain the difference between a controlled nuclear reaction and an uncontrolled nuclear reaction.  Controlled reaction has 1 neutron per event used for the next event in the chain.  Uncontrolled reaction can have all 3 neutrons  c) State and describe two features of a nuclear reactor that enable a controlled nuclear reaction to continue and be controlled?   1. The moderator slows neutrons down so they can be absorbed   Deuterium and/or Tritium as a slightly larger mass than neutrons  slows the neutrons down due to multiple collisions- shares energy   1. The control rods contain neutron poisons   such as B and Cd  absorb neutrons | (1)  (2)  (2)  (2) |
| **3.** | (a)  (i)What high level nuclear waste products are produced in a nuclear facility?  Spent fuel rods  (ii) How are they stored?  Cooled in water for 5 to 50 years  Dry ventilated concrete containers, deep underground | (1)  (2) |
| 4 | 1. List two effects of radiation on humans?   Eg. Cancers, genetic damage, mutations, lymphatic system failure, seizures etc   1. List two ways to make it safer for humans working in the nuclear industry.   Shielding such as lead  Radiation monitoring | (2)  (2) |
| 5 | (a) In the following table list advantages and disadvantages of nuclear power   |  |  | | --- | --- | | Advantages | Disadvantages | | Efficient power production  Requires relatively small amount of uranium  Doesn’t produce greenhouse gases. | Radiation dangerous to humans and living animals and plants.  Leakage into the environment  Long storage times for radioactive waste.  Long term effects if something goes wrong, eg. Three Mile Island, Chernobyl and Fukishima |  1. Write a short paragraph explaining your view on nuclear power and whether it is a viable long term solution to global warming.   *(Be concise and use scientific reasons to support your statement, 3 marks indicates you should give 3 reasons to support your statement)* | (3)  (3) |