**6.4 HONORS CLASS WORKSHEET – NUCLEAR ENERGY**

1. **Binding Energy and Mass Defect**

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| Consider the following nuclear reaction: + 🡪 +  mass of = 2.014 amu, mass of = 3.016 amu, mass of = 4.003 amu, mass of = 1.009 amu  Show your working in all calculations: | | |
| (a) | Calculate the mass defect for this reaction  (in amu) |  |
| (b) | Calculate the mass defect for this reaction  (in kg) (1 amu = 1.66 x 10-27 kg) |  |
| (c) | Calculate the energy released during this reaction (per He atom) (c = 3 x 108 m/s) |  |
| (d) | Calculate the energy released during this reaction (per mole of He atoms)  (L = 6.02 x 1023 mol-1) |  |

1. **Nuclear fission**

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| An example of a nuclear fission reaction is 🡪 + + 2 | | |
| (a) | Write nuclear equations for the following fission reactions: | |
| (i) | The fission of Uranium-235 to produce caesium-144 and rubidium-90 |
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| (ii) | The fission of plutonium-239 to produce xenon-134 and zirconium-103 |
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| (b) | Explain why nuclear fission can result in a “chain reaction”. | |
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| (c) | Explain the role of boron rods in a nuclear reactor. | |
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| (d) | Explain the main environmental problem associated with nuclear fission reactions. | |
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1. **Nuclear fusion**

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| An example of a nuclear fusion reaction is + 🡪 + | | |
| (a) | Where does the above reaction take place and why is it important? | |
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| (b) | Write nuclear equations for the following fusion reactions: | |
| (i) | The fusion of two hydrogen-2 nuclei to produce helium-3 and one other particle |
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| (ii) | The fusion of hydrogen-1 and carbon-12 into a single particle |
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| (c) | Give two reasons why nuclear fusion is, in principle at least, a better way to generate nuclear power than nuclear fission | |
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| (d) | Give two reasons why there are currently no nuclear fusion power stations on earth. | |
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