Hand-in problems (Nuclear Physics, Hand-out: October2, Deadline: October 9)

1) For each of the following nuclei use the Bethe-Weizsäcker formula to compute the total binding energy : ^{21}Ne, ^{209}Bi, ^{57}Fe, ^{256}Fm

2) Give the expcted shell-model spin and parity assignment for the ground states of ^{7}Li, ^{11}B, ^{15}C, ^{17}F, ^{31}P and ^{141}Pr

3) Use the Bethe-Weizsäcker formula to estimate the α-decay energy of ^{242}Cf

4)

Supply the missing component(s) in the following processes:
(a) $\bar{\nu} + {}^{3}\text{He} \rightarrow$
(b) $^{6}\text{He} \rightarrow {}^{6}\text{Li} + e^{-} +$
(c) $e^{-} + {}^{8}\text{B} \rightarrow$
(d) $\nu + {}^{12}\text{C} \rightarrow$
(e) $^{40}\text{K} \rightarrow \nu +$
(f) $^{40}\text{K} \rightarrow \bar{\nu} +$

5) Calculate the form factor for a density distribution (ρ_0, R are constant):

$$\rho(r) = \rho_0 \, e^{-r/R}$$

6) Around christmas 1938 the nuclear fission process was discovered. Who did this discovery? This was less than a year before the start of World War II. Was it right to publish the results concerning fission at that time (the results were presented in 1939)?

7) Atomic bombs are considered a serious threat to human kind. As a nuclear scientist you have the expertise to warn humankind about them and to propose means to mitigate that thread. You understand that your predictions on their impact are rather uncertain. Is it justified (as a scientist) to simplify the complexities of the predictions or to exaggerate the impact in order to gain the attention of the general public?