Physics 313, Fall 2018 – Homework 2, submission form.

Due Monday, Nov. 26, 2018.

Your name: ……

Your OSU ID #: ……(the last four digits)

Please fill in the numbers (plus their units!) you have obtained from your calculations:

(a) Your answer to (a), i.e, what's the efficiency of an ideal Carnot Engine operating at the conditions described in the text? (don't look too much at the picture now, you should Rather focus on what's written by words):

.....

Do you believe that your result is correct? Yes No (underline your answer).

(b) Your answer to (b), i.e, what's the max efficiency of a "power-maximizing" thermal engine operating at the same conditions as specified at the end of the first paragraph in the problem statement?

..... Do you believe that your result is correct? Yes No (underline your answer).

(c) Consider first, what is the "thermal energy input" every second? Note: 27 centigrade water flows in, and when it flows out, it has 16 centigrades. 1750 kilograms every second! (remember, 1 J/s is 1 Watt) :…….. Do you believe that your result is correct and makes sense? Yes No (underline your answer).

What's the definition of the efficiency of a heat engine? Considering the result you have obtained for the efficiency, how much mechanical power (convertible to electricity) may a thermal engine yield, if it receives such thermal power input? ……

(d) How much will be left after the pumps take their "portion", 1 MW? …….

SHOW ALL YOUR WORK ON ANOTER PAGE, OR JUST ON THE BACK OF THIS ONE.

Extra comment (no need to print what's on the next page): some students have noticed that since the cooling water is heated up from 5°C to 16°C, i.e., by 11°C – the same amount by which the warm surface water is cooled down – it would mean that the same amount of energy as is taken from the warm water is "dumped" for heating up the cold water, so no work can be generated, because "thermal energy out = thermal energy in". It's a very good point! – but no need to worry. Note that in the problem statement it is said: *to a **slightly lower** temperature than 16°C.* You may assume that all temperatures in the facility were measured using a digital thermometer showing only whole numbers, not decimals, so all temperatures higher than 15.5 °C (and lower than 16.5 °C) are displayed as 16 °C.

In fact, if we subtracted the energy corresponding to the output work from the energy corresponding to the heat intake, we would find that cold water would be heated up not by 11°C, but only by approximately 10.6 °C. I.e., to 15.6°C, which is indeed *a slightly lower temperature* than 16°C.

In summary of the above -- not necessarily there is a discrepancy, just ignore the info about the temperature increase of the cooling water – in fact, it is not needed for obtaining answer to any of the questions in the problem.