Name: _____ **/50**

Yr 12 Physics EMR Test 2017

Instructions

1. Answer all questions in the spaces provided.
2. Give all numerical answers to three significant figures, except when you are required to estimate values where two significant figures will be appropriate.
3. Show all working – marks may be awarded for logical working even when an incorrect final answer is arrived at.
4. If you require extra working space, there are blank pages at the back of test – ensure you clearly label where your answers are.

50 marks for the questions, up to 2 marks may be deducted for incorrect units and / or significant figures

QUESTION ONE **(5 marks)**

Around the beginning of the 20th Century, new revelations in Physics saw light take on a dual nature.

a) Describe the nature of light's duality. (1 mark)

b) Use two famous experiments or physical effects to explain how this dual nature of light. (4 marks)

QUESTION TWO **(3 marks)**

The street lamps lining the Mitchell freeway have bulbs containing sodium vapour and emit have a distinct yellow / orange colour when the vapour is exposed to a high voltage. Explain, with the aid of simple diagrams, how this light is produced.

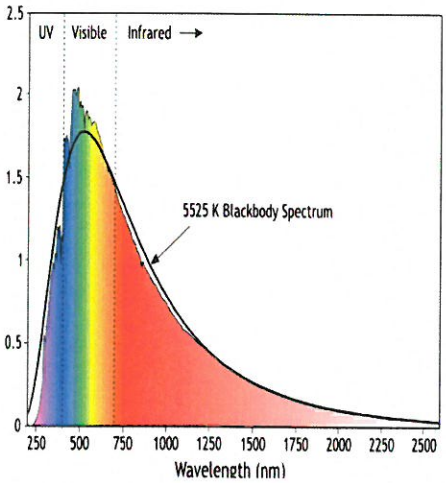
QUESTION THREE **(3 marks)**

Determine the De Broglie wavelength of a 156g cricket ball, with a diameter of 7.05cm, travelling at 158km/h.

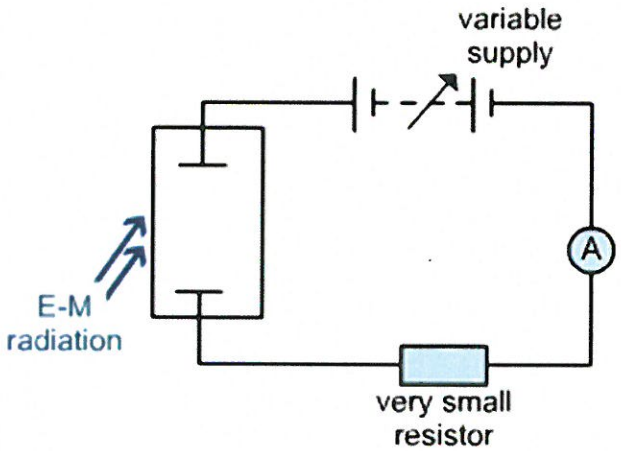
QUESTION FOUR **(4 marks)**

The diagram on the right shows the spectrum emitted by the sun.

Explain why the spectra emitted by blackbodies always have this same general shape.



QUESTION FIVE **(8 marks)**



The diagram on the left shows the apparatus used to determine the threshold frequency of various metals. The metal shentonium required a stopping voltage of 1.76V when light of wavelength 245nm was directed onto it.

Determine:

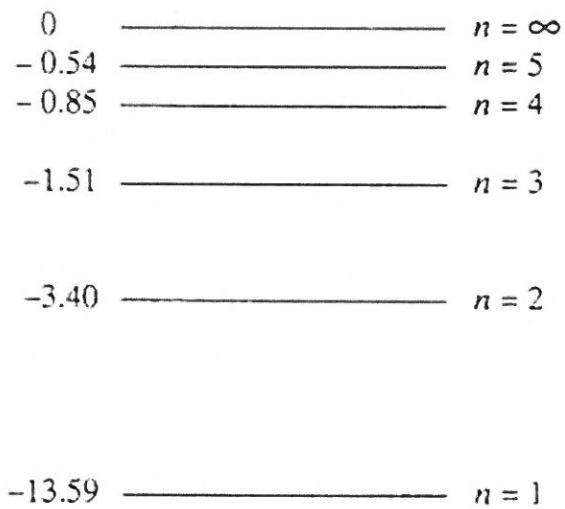
a) The frequency of this light (1 mark)

b) The work function of shentonium (2 marks)

c) The threshold frequency of shentonium (2 marks)

d) Increasing the brightness of the 245nm light does not increase the stopping voltage. Explain. (3 marks)

QUESTION SIX **(10 marks)**



The diagram on the left shows the electron energy states around an atom. The numbers down the left hand side show energy quantities in eV.

a) If an electron jumps up from the groundstate to the n=4 level, show on the diagram all the possible transitions it can make when returning to the ground state.

(2 marks)

b) Determine the energy, frequency and wavelength that the most energetic photon that could be emitted would have, and which part of the EMR spectrum it would belong to. (4 marks)

c) If the light from a very hot blackbody (like the sun, for example) was shone through a cold sample of this gas, a particular spectrum would be observed.

(i) Describe its appearance. (1 mark)

(ii) Explain how this spectrum is created. (3 marks)

QUESTION SEVEN **(8 marks)**

If a metal is **vaporised** and heated it will emit a spectrum that **looks different** to the spectrum emitted by a hot **solid** sample of the same metal when viewed through a spectroscope.

a) Describe the appearance of the typical types of spectrum these hot objects emit. (2 marks)

b) Explain how these spectra are produced, being sure to explain why they appear different. (6 marks)

QUESTION EIGHT **(4 marks)**

A laser used for astronomy nights has a power of 5.00mW and emits light of wavelength 532 nm. Determine the number of photons emitted per second by this laser.

QUESTION NINE **(5 marks)**

Steve was conducting an investigation into the effect of shining UV light onto various materials. He found that when he illuminated some materials, such as a piece of gypsum, it glowed brightly, but stopped glowing when the UV light source was removed. He also found that materials, such as a watch dial, glowed but not as brightly and continued to glow for some time after the UV light source was removed. Name and explain the two phenomena Steve was investigating.