FAKE FINAL EXAMINATION

Dec. 2007

DURATION: 3 HOURS No. of Students: **30**

Department Name & Course Number: **BIT 1002**
Course Instructor(s) P. J. S. Watson

AUTHORIZED MEMORANDA

one 8.5x11 sheet, calculator

Students MUST count the number of pages in this examination question paper before beginning to write, and report any discrepancy to a proctor. This question paper has 5 pages.

This examination question paper MAY NOT be taken from the examination room.

In addition to this question paper, students require: an examination booklet yes X no
a Scantron sheet yes no X

Student Name…….. **Student Number** …….

Useful constants : note not all of them are required in this exam

1 eV =1.6 x 10^{-19} J ; g = 9.81 ms^{-2} G = 6.67 x 10^{-11}N $kg^{-2}m^2$ k = $1/(4\pi\epsilon_0)$ = 8.99x 10^9 Nm^2C^{-2} ϵ_0 =8.85x$10^{-12}N^{-1}m^{-2}C^2$ μ_0 = $4\pi x10^{-7}$ TmA^{-1} Electron Mass m_e = 9.1x10^{-31} kg. Proton Mass m_p = 1.67x10^{-27} kg. Ionization energy of H atom E= 13.6eV Electron/proton charge |e| = 1.6 x 10^{-19} C	Atomic Mass unit u = 1.66x10^{-27} kg = 931.5 MeV/c^2 ; Speed of Sound in air = 330 ms^{-1} Speed of light c = 3.0 x 10^8 ms^{-1} Planck's constant h = 6.63 x 10^{-34} Js ; Ionization energy of H, E = 13.6 eV ; Latent heat of fusion for water = 333 kJ kg^{-1} Latent heat of Vaporization for water = 2260 kJ kg^{-1} Specific Heat of water = 4.126 kJ $°C^{-1}kg^{-1}$ Gas Constant R = 8.314 J mol^{-1} K^{-1} Stefan-Boltzmann constant 5.67x$10^{-8}Wm^{-2}K^{-4}$ Boltzmann Constant k_B=1.38x10^{-23}

This examination has 2 parts: Part I consists of 20 Multiple Choice Questions.

Part II: consists of 5 Problems.

Part I: **Multiple Choice Questions:** attempt all 20. 2 marks each**,** no penalty for incorrect answers. Circle the correct answer. If you feel that none of the answers are correct, write down your answer with an explanation.

1. X-rays are
    1. Very short wave-length electromagnetic radiation
    2. very low energy photons
    3. very short wave-length sound waves
    4. produced by the hydrogen atom
    5. very low energy neutrinos

2. If someone's vision is myopic in one eye, it would be corrected by using
    1. A telescope
    2. A microscope
    3. A concave lens
    4. A convex lens
    5. A convex mirror
3. Water has a refractive index of 1.33. The critical angle for light coming from water to air would be
    1. 36.9°
    2. 45°
    3. 90°
    4. 48.8°
    5. 41.7°
4. A metal has a work function of 2.7 eV. If ultra-violet light with a frequency of $2x10^{15}$ Hz hits it, the maximum energy of the ejected electrons will be
    1. 2.7 eV
    2. 5.55 eV
    3. 8.25 eV
    4. $2x10^{15}$ eV
    5. You need to know the wavelength
5. Light with a wavelength of 500 nm falls on a diffraction grating with 6000 lines/cm. The first order spectrum will occur at
    1. 50°
    2. 17.5°
    3. 36.9°
    4. 0°
    5. 45°
6. A convergent lens produces a sharp image on a wall when the distance from the object are $d_1 = 20$ cm and $d_2 = 60$ cm. Assuming that the distance between the object and the wall is the same, the focal length of the lens is (in cm)
    1. 10
    2. 15
    3. 20
    4. 25
    5. 30
7. The speed of light in a substance is $1.67x\ 10^{8}$ m/s . The critical angle substance-air is (in degrees)
    1. 22.5
    2. 36.9
    3. 88.4
    4. 90.0
    5. 48.8

8. A simple telescope has $f_e = 0.05$ m and $f_o = 2.0$m. The magnification of the telescope is
    1. 40
    2. 6
    3. 20
    4. 1000
    5. 120
9. Which of the following objects is <u>not</u> accelerating?
    1. A stone which is in free-fall
    2. A stone inside an elevator which is in free fall
    3. A satellite in orbit round the earth
    4. A stone sliding along a frictionless surface
10. A sprinter has a terminal velocity of 12 m s^{-1}, and it takes him 3 s to get up to full speed. How far does he travel during this time?
    1. 30 m
    2. 36 m
    3. 4 m
    4. 15 m
    5. 18 m
11. 5) A man runs towards the back of a train traveling at 30 ms^{-1}. If his speed is 5 m s^{-1}, what is his speed relative to the ground?
    1. 25 ms^{-1}
    2. 35 ms^{-1}
    3. 30 ms^{-1}
    4. 150 ms^{-1}
    5. -30 ms^{-1}
12. A car with a maximum power output of 70 kW has a maximum speed of 150 km/hr. Assume that the resistive force has the form $F = - kv^2$, the value of k is
    1. 9680
    2. 12
    3. 0.968
    4. 120
    5. .00012
13. A baseball is thrown over a distance of 60 m with a launch angle of 35°. What would its launch velocity need to be?
    1. 30 ms^{-1}
    2. 16 ms^{-1}
    3. 25 ms^{-1}

4. 76 ms^{-1}
5. 7 ms^{-1}

14. A gas is heated from 30°C to 80°C at constant volume. Its pressure will increase by a factor of
    1. 4
    2. 1.16
    3. 16
    4. 1/4
    5. 1.0001
15. A metal with a linear coefficient of expansion of $3x10^{-6}$ is heated from 20°C to 80°C. If it was originally 80.000 cm long, its new length will be
    1. 80.007 cm
    2. 4800 cm
    3. 80.7 cm
    4. 20.3 cm
    5. 91.0 cm
16. A spring is extended .2 cm when a 60 g weight is hung from it. The spring constant k is
    1. 2940 Nm^{-1}
    2. 30 Nm^{-1}
    3. 16 Nm^{-1}
    4. 1/4 Nm^{-1}
    5. 294 Nm^{-1}
17. A Guitar string is 70 cm long and produces a fundamental note of A (440 Hz). What is the speed of the wave in the string?
    1. 616 ms^{-1}
    2. 308 ms^{-1}
    3. 154 ms^{-1}
    4. 1232 ms^{-1}
    5. 628 ms^{-1}
18. A gas is heated from 20°C to 80°C at constant volume. Its pressure will increase by a factor of
    1. 4
    2. 1.16
    3. 16
    4. 1/4
    5. 1.0001
19. A kid whirls a stone weighing 150 g. on a string round his head. If the string is 30 cm. long and has a breaking strain of 400N, when it breaks the stone will fly off with a speed of
    1. 28.3 ms^{-1}
    2. 800 ms^{-1}
    3. 73.4 ms^{-1}

4. 1/4 ms^{-1}
5. 12.6 ms^{-1}

20. A skier goes down a hill with a vertical drop of 30 m. Ignoring friction, his speed at the end will be
    1. Unknown unless you are given his mass
    2. 12 ms^{-1}
    3. 24.3 ms^{-1}
    4. 294 ms^{-1}
    5. 33 ms^{-1}

Part II: Problems: Each problem is worth 20 marks. It must be answered clearly and you must give a systematic explanation in clear English: simply writing a formula is not adequate. If appropriate, draw a diagram. Attempt 3 (out of the 5) questions. If you do more than 3, cross out the ones you don't want marked

1. A microscope consists of a 0.5 cm focal length objective and a 2.3 cm focal length eyepiece. The barrel (distance between the lenses) is 25 cm long when the final image is at infinity.
    1. Draw a ray diagram showing how the final image is formed
    2. Where must the original object be?
    3. What is the magnification produced by the objective?
    4. What is the overall magnification of the system, taking your near-point to be 20 cm.
2. A prism, all angles 60^o, is placed so that a ray of light has incident angle of 45^o. The index of refraction of the prism is n= 1.7. Calculate the deflection of the ray.
3. A vector has components $V_x = 14$, $V_y = -5$.
    1. Sketch this and find its length and the angle it makes with respect to the positive x--axis.
    2. A vector of length 25 with an angle of 30° to the x-axis is added to it. What is the length of the resultant vector?
4. A car accelerates from rest to a final speed of 30 m/s in 7 s.
    1. What is its acceleration?
    2. How far does it go?
    3. If there is a constant frictional force of 800 N, how much energy is required?
5. 100 g of steam at 100°C and 100 g. of ice at 0°C are mixed together.
    1. What is the final temperature?
    2. How much of the ice has melted, and how much of he steam has condensed?
    3. Does the entropy of the system increase, decrease or stay the same?