Physics Mid-Term Exam made by Michael in May of 2017.

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s is your student number. k = s mod 10000. T = s mod 100. m = s mod 35. a = s mod 25.

L = s mod 10. $d\_{2}=\frac{T-L}{10}$. e = s mod 8. m7 = s mod 7. m6 = s mod 6. m4 = s mod 4. m3 = s mod 3.

m2 = s mod 2.

Each problem is the same number of marks.

Significant figures:

1.1. How many significant figures are there in your s and T?

1.1.2. How many significant figures are there in your student number?

1.1.3. Give the number of significant figures of the number for your T.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1: 8778000 | 2: 0.000567 | 3: 80600 | 4: 0.00067900 | 5: 346000 |
| 6: 0.000673 | 7: 95328000 | 8: 943258000 | 9: 0.000774 | 10: 9900 |
| 11: 987890 | 12: 0.0000561 | 13: 94034600 | 14: 900653540 | 15: 0.005469 |
| 16: 4365600 | 17: 0.003268 | 18: 456700 | 19: 467000 | 20: 0.0000676 |
| 21: 36.00800 | 22: 65.00 | 23: 0.00000 | 24: 7890000 | 25: 0.0003 |
| 26: 65765700 | 27: 0.000500 | 28: 56456000 | 29: 0.00056 | 30: 6756700 |
| 31: 674670 | 32: 0.00654 | 33: 434500 | 34: 0.020450 | 35: 8760076 |
| 36: 0.0065400 | 37: 5689400 | 38: 0.000600 | 39: 5930300 | 40: 0.007700 |
| 41: 4920010 | 42: 4090330 | 43: 0.0750000 | 44: 490304457 | 45: 0.0060700 |
| 46: 4790650 | 47: 0.0006277 | 48: 50403460 | 49: 0.0060600 | 50: 490400600 |
| 51: 000000 | 52: 589500 | 53: 96400800 | 54: 0.0045045 | 55: 358000500 |
| 56: 0.00143 | 57: 32122000 | 58: 1258000 | 59: 0.001474 | 60: 51200 |
| 61: 187890 | 62: 0.000021 | 63: 94034100 | 64: 200653540 | 65: 0.005419 |
| 66: 4362600 | 67: 0.003268 | 68: 412700 | 69: 427000 | 70: 0.0000671 |
| 71: 174170 | 72: 0.00214 | 73: 434300 | 74: 0.020410 | 75: 8230021 |
| 76: 0.0012400 | 77: 2189400 | 78: 0.000200 | 79: 1930300 | 80: 0.003200 |
| 81: 1920010 | 82: 4020330 | 83: 0.0120000 | 84: 490304432 | 85: 0.0060300 |
| 86: 000000 | 87: 589100 | 88: 92400800 | 89: 0.0041045 | 90: 358000200 |

Accuracy and precision:

1.1.4. Draw the example of:

m4 = 0: accurate and precise.

m4 = 1: accurate and NOT precise.

m4 = 2: NOT accurate and precise.

m4 = 3: NOT accurate and NOT precise.

Errors:

1.2. Calculate the compound errors for x = s, dx = 1/T; y = T, dy = 1/k.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/compound\_errors.txt

Mechanics:

2.1. Solve the projectile problem for V0 = T meters per second and A = T degrees.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/code4projectile.txt

http://physics16.weebly.com/uploads/5/9/8/5/59854633/code4h4projectile.txt

2.1.2. Find the projectile release angle for the maximum distance = k and for the initial velocity V0 = k. Find the projectile release angle for the distance d = k, height h = k/7

 and for the initial velocity V0 = k.

 http://physics16.weebly.com/uploads/5/9/8/5/59854633/code4projectile.txt

 http://physics16.weebly.com/uploads/5/9/8/5/59854633/code4h4projectile.txt

2.2. Find velocity and acceleration for one-dimensional motion with the equation x = -k + Lt + Tt2.

3.1. Find angular velocity and linear acceleration for v = T m/s and R = k meters.

Vectors:

3.1.2. Add, subtract and multiply the vectors (T,k) and (L,s).

http://physics16.weebly.com/uploads/5/9/8/5/59854633/vectors\_arithmeric\_difference\_sum\_products.txt

Collisions:

3.2.2. Calculate the final speed after absolutely inelastic collision of two balls of masses L kg and T kg, moving with velocities s m/s and k m/s respectively.

 http://physics16.weebly.com/uploads/5/9/8/5/59854633/inelastic4collision.txt

3.2.3. Solve the elastic collision problem for u1 = k, u2 = k/2, m1 = k, m2 = 2k.

 http://physics16.weebly.com/uploads/5/9/8/5/59854633/linear2elastic4collision.txt

Pulleys:

4.1. Find the acceleration of a simple pulley for two masses: L kg and T kg.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/problem4pulleys.txt

Inclined plane:

4.2. Find acceleration of a mass at inclined plane with A = T degrees and friction coefficient μ = 1/T.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/inclined4plane.txt

Center of mass:

5.1. Find the center of mass of k equal masses k meters apart located on a straight line.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/center\_of\_mass\_of\_k\_masses.txt

Statics:

5.2. Find the hangover for the s blocks in the blocks stacking problem.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/hangover.txt

5.2.2. Work and energy:

m3 = 0: What is energy?

m3 = 1: Explain work.

m3 = 2: What is energy conservation?

5.2.3. Fluids:

m2 = 0: Explain Bernoulli Principle.

m2 = 1: What is Magnus Effect?

Thermodynamics:

6.0. The thermal expansion rate α is 1/k. The temperature change is T degrees.

a. Find the extension of m meters rod due to the temperature change.

b. Find the approximate volume change of m meters cubed cube due to the temperature change.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/thermal4expansion.txt

6.1. There are two bodies in a thermodynamically isolated system: C1 m1 T1 and C2 m2 T2. Find the resulting temperature T. m1 = k, m2 = 2k. C1 = k/11, C2 = k/222, T1 = k/111, T2 = k/22

http://physics16.weebly.com/uploads/5/9/8/5/59854633/result4temperature.txt

6.2. Estimate the distances between the atoms of element number T in the periodic table of elements.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/distance\_between\_particles.txt

Oscillations:

m7 = 0: 6.2.2. Explain oscillations.

6.2.3. Find the displacement of a harmonic oscillator after s seconds with amplitude k, frequency k and initial phase k/2.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/harmonic4oscillator.txt

7. Solve string oscillatory equation for v = T, f = A= 1. Find displacement after s seconds at m meters.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/string\_equation\_solution.txt

Waves:

m7 = 1: 7.2. A 100 W lamp emits electromagnetic radiation in all directions. Assuming a lamp to be a point source, calculate the intensity of the radiation:

a. at distance of 1 m from the lamp.

b. at distance of 2 m from the lamp.

Power = 100

R = 2

pi = 4 \* Atn(1)

Area = 4 \* pi \* R ^ 2

intensity = Power / Area

MsgBox intensity

m7 = 2: 7.3. Waves from a source have an amplitude of 5 cm and an intensity of 400 Wm-2.

a. The amplitude of the waves is increased to 10 cm. What is their intensity now?

b. The intensity of the waves is decreased to 100 Wm-2. What is their amplitude?

intencity = 400

amplitude = 5 \* 10 ^ (-2)

constant = intencity / amplitude ^ 2

amplitude2 = 10 \* 10 ^ (-2)

intencity2 = constant \* amplitude2 ^ 2

MsgBox intencity2

intencity3 = 100

amplitude3 = (intencity3 / constant) ^ (1 / 2)

MsgBox amplitude3

m7 = 3: 7.4. Red light of wavelength 700 nm in a vacuum travels into glass, where its speed decreases to 2×108ms-1. Determine:

a. the frequency of the light in vacuum

b. its frequency and wavelength in glass.

wavelength = 700 \* 10 ^ (-9)

c = 300000000

frequency = c / wavelength

MsgBox frequency

c2 = 200000000

wavelength2 = 200000000 / frequency

MsgBox wavelength2

m7 = 4: 7.5. An astronomer observes light from a distant star. A particular line in its spectrum has a wavelength of 550 nm. When measures in the laboratory, the same spectral line has a wavelength of 535 nm. Determine:

a. the change in the wavelength of the spectral line

b. the speed of the star

c. the direction of the movement of the star (towards or away from the observer).

c = 300000000

lambdao = 550 \* 10 ^ (-9)

lambdas = 535 \* 10 ^ (-9)

vs = c \* (lambdao / lambdas - 1)

MsgBox vs

m7 = 5: 7.6. Describe how the fans in a stadium must move in order to produce a longitudinal stadium wave.

m7 = 6: 7.7. A science fiction film depicts inhabitants of one spaceship (in outer space) hearing the sound of a nearby spaceship as it zooms past at high speeds. Critique the physics of this film.

m7 = 0: 7.8. The sonar device on a fishing boat uses underwater sound to locate fish. Would you expect sonar to be a longitudinal or a transverse wave?

m7 = 1: 7.9. Give superposition of the waves.

m7 = 2: 7.10. What is diffraction?

m7 = 3: 7.11. Give the solution for the stationary waves.

m7 = 4: 7.12. Explain the similarities and the differences of mechanical and electromagnetic waves.

m7 = 5: 7.13. What is Doppler Effect?

m7 = 6: 7.14. Does the frequency of the wave change as it goes from one medium to another? Why?

8. Find the wavelength for v = k m/s and f = T Hz.

Maxwell Equations:

9.0. Solve the simplified Maxwell Equations for c = 300000000-s, red light. Take amplitude 1 V/m. Find the intensity of electric field after s seconds at m meters.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/maxwell\_equations\_solution.txt

Coulomb Law:

9. Find the force between two charges of L and T Coulombs for the distance apart of m meters.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/coulomb\_force.txt

9.2. Scattering:

m3 = 0: What color is the Sun?

m3 = 1: Why are clouds white?

m3 = 2: Why is the sky blue?

Project:

10. Improve your project.