Physics Summative Exam

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Contents

1 Mark Distribution → 140 Marks

1.1 Summary

- Unit 1: Dynamics and Motion → 35 Marks + 5 Bonus
- Unit 2: Fields → 30 Marks
- Unit 3: Momentum + Energy → 30 Marks
- Unit 4: Light as a Wave → 35 Marks
- Unit 5: Quantum → 10 Bonus Marks

1.2 Matrix

like the one mrs beamer shows in the examples

2 Unit 1 - Dynamics and Motion (35)

2.1 Solve for each of the following (20)

Your solutions must include a diagram and a written conclusion to be considered for full marks.

2.1.1 Incline Plane (5)

2.1.2 90° Pulley System (5)

2.1.3 Solve using Newton's Laws (5)

2.1.4 Projectile Motion Type 1 (5)

2.2 Theory (5)

2.2.1 What is Isaac Newton's Second Law of Motion?

a) $v = \frac{\Delta d}{\Delta t}$

b) $F_{net} = ma$

c) $E_k = \frac{1}{2}mv^2$

2.2.2 What is Isaac Newton's Third Law of Motion?

a) For every action there is an equal and opposite reaction.

b) For every action there is an unequal reaction in the opposite direction.

c) Earth's gravity causes objects to fall to the ground.

2.3 Labs (10)

2.3.1 What is the procedure for the Projectile Motion Lab? (5)

Your procedure must be a minimum of 5 steps.

2.3.2 What is the procedure for the Fletchers Trolley Lab? (5)

Your procedure must be a minimum of 5 steps.

3 Unit 2 - Fields (30)

3.1 Milikans Oil Drop Experiment (10)

3.1.1 Draw the diagram for this experiment (5)

Your diagram must be labeled properly.

3.1.2 What is the significance of this experiment? (5)

Your answer should contain a minimum of 300 characters.

3.2 Electrostatic Forces and Electric Field Intensity (20)

Three charged objects are located at the vertices of a right triangle. The first charge (Charge A) has a charge of $+6.7\mu C$ and is located at the coordinate $(0, 0)$. The second charge (Charge B) has a charge of $-3.5\mu C$ and is located at the coordinate $(0, 3)$. The third charge (Charge C) has a charge of $-2.0\mu C$ and is located at the coordinate $(4, 0)$. Point D is located at the coordinate $(4, 3)$. The difference in coordinates is measured in centimeters.

a) What is the magnitude of the force on Charge A? (5)

b) What is the magnitude of the force on Charge B? (5)

c) What is the magnitude of the force on Charge C? (5)

d) What is the magnitude of intensity on point D? (5)

4 Unit 3 - Momentum + Energy (35)

4.1 Theory (5)

4.1.1 Describe how Banked Curves work (3)

Your answer should contain a minimum of 100 characters.

4.1.2 What are two ways to reduce the force of a collision? (2)

Your answer should contain a minimum of 200 characters.

4.2 Labs (5)

4.2.1 What is the procedure for the 2D Momentum Lab? (5)

Your procedure must be a minimum of 5 steps.

4.3 Solve for each of the following (20)

Your solutions must include a diagram and a written conclusion to be considered for full marks.

4.3.1 Energy + 2D Momentum (10)

Jeremy rolls a bowling ball with a mass of 6.7 kg directly at a stationary bowling pin that has a mass of 3.0×10^{-3} kg. The bowling ball is 0.97m above the ground and moving 1.2 m/s before Jeremy releases it. After the collision, the bowling ball rolls off at a 32° angle counter-clockwise with a velocity of 3.1 m/s. What is the after velocity of the bowling pin?

4.3.2 Spring Energy + Inelastic Momentum (10)

A child; Michael, with a mass of 20 kg is running towards a rope at a velocity of 2.4 m/s. Michael sticks to the rope after their collision and swings forward. The rope is very old so when Michael reaches his highest peak, the rope breaks. Michael falls to the ground and luckily lands on a trampoline. The trampoline compresses 8.9 cm before bouncing back to its original height.

Solve for each of the following:

a) What is the velocity of Michael and the rope after their collision?

b) What is the velocity of Michael after the collision with the trampoline?

c) What is the spring constant of the trampoline?

4.3.3 Momentum + Energy + Kinematics + Forces (Bonus 5)

5 Unit 4 - Light as a Wave (35)

5.1 Theory (25)

5.1.1 Why does an interference pattern appear for single slits? (5)

Your answer should contain a minimum of 200 characters.

5.1.2 Why does an interference pattern appear for double slits? (5)

Your answer should contain a minimum of 200 characters.

5.1.3 Draw the intensity chart for both double and single slits (5)

Your intensity charts must be labeled properly.

5.1.4 Briefly summarize each of the following (10)

Your summaries should contain a minimum of 120 characters.

a) Diffraction Gratings

b) Polarization

c) Red light vs Green light

5.2 Solve for each of the following (10)

Your solutions must include a diagram and a written conclusion to be considered for full marks.

5.2.1 Double Slit (5)

Monochromatic light is shone through two slits 4×10^5 nm apart. The fringes on the screen are $d \times 5 \times 10^3$ away from the slits and have a central maxima width of 2×10^{-4} km. What is the wavelength of the light? What color would the light be?

5.2.2 Single Slit (5)

How wide is a single slit if it diffracts a 470 nm beam of light such that it produces a central maxima width of double 3.0 cm on a screen 1.2 m away?

6 Unit 5 - Quantum (10 Bonus Marks)

6.1 Describe Wave-Particle Duality (5)

Your description should contain a minimum of 300 characters.

6.2 Elaborate on one of the following (5)

Your description should contain a minimum of 300 characters.

a) Schrödinger's Cat

b) Superposition

c) Heisenberg Uncertainty Principle