Date: _____ **Instructors:** TONI JANOVICH, ERIC WOLGEMUTH

Student Name/ID#: _____

Total Score: / 35

GIG HARBOR HIGH SCHOOL - PHYSICS S2: 1(A), 3(A), 6(A)

Work, Power & Energy - Unit Test

INSTRUCTIONS: This is a timed test that lasts for the duration of this period *only*. You do not have additional time on this test unless I have a note from your counselor (as always).

For written/bulleted responses: please be sure and use subscripts such as X_i, Y_f, Z_1 and superscripts such as a^2, b^3, c^2 and symbols such as Δ appropriately. I have turned on the scientific calculator for this test if you need it.

QUESTION 1 /1

Joules are the unit of measure for? [ ]

1 Work | 2 Power | 3 Momentum | 4 Energy

QUESTION 2 /1

NM are the unit of measure for? [ ]

1 Work | 2 Power | 3 Force | 4 Momentum

QUESTION 3 /1

Joules per second is another way of talking about [ ]

1 Work | 2 Power | 3 Energy | 4 Momentum

QUESTION 4

/1

A Newton meter is another way to talk about [ ]

1 Energy | 2 Force | 3 Power | 4 Momentum

QUESTION 5

/1

When we are talking about force acting through a specific displacement we are talking about: 1 [ ]

Choose one option for each blank section

1 Power

1 Energy

1 Momentum

1 Work

QUESTION 6

/1

The total mechanical energy of an object falling through the air *at any m moment* can best be stated as:

1 [ ]

Choose one option for each blank section

1 ΔKE + ΔUg + Heat

1 ΔKE + ΔUg = 0

1 ΔKE + ΔUg = +/- Work

1 Total KE at that moment + Total Ug at that moment - Total Heat Lost Up to That Moment

QUESTION 7

[ ] /1

The equation $\Delta KE + \Delta U_g = 0$ tells us that: [ ]

1 We are not considering friction in this situation

2 Friction may be absent in this situation

3 Energy may be transferred back and forth between Kinetic Energy and Potential Energy but no energy is lost

4 All of these options can be used to describe that formula

QUESTION 8

[ ] /1

The equation $\Delta KE + \Delta U_g = \pm W$ tells us that: [ ]

1. Heat is added to that system in this case
2. Heat is lost from that system in this case
3. Heat may either be added or lost in this situation
4. All of these options can be used to describe that formula

QUESTION 9

[ ] /2

You pull on a rope attached to a bag of cement in an attempt to drag it across your back yard. The bag of cement has a mass of 125.0 kg. You pull on that bag with a force of 517.0 N and drag it a displacement of 25.20 meters at an angle of 17.50 degrees to the horizontal.

How much work did you do pulling that bag of cement?. [ ]

1. 30,900 NM
2. 21,530 NM
3. 13,030 NM
4. 12,430 NM

QUESTION 10

[ ] /4

A 17.5 kg object is dropped from the deck of the Tacoma Narrows Bridge 57.15 meters above the waters of Puget Sound. Write a bulleted list that does the following:

1) Show you calculations for the total gravitational potential energy that the object has at the moment it is dropped and write that as bullet item #1

2) List as additional bulleted items each the step required to find the maximum velocity the ball will obtain if we ignore friction

3) Show that velocity as the last bulleted item in your list

QUESTION 11

/2

You're pulling your 5 year kid sister on her favorite sled across the snow in your backyard. Your kid sister ain't as little as she used to be and you have to exert a bit more force then you used to. Remembering Mr W's physics class, you lower the angle the rope makes to the horizontal and *voila* you can put the same amount of force into moving your sister and get even better results. Your kid sister is pretty bright and she asks why you did that.

Please explain to your 5 year old sister why you lowered the angle the rope makes to the ground as you pull her along. 1

Choose one option for each blank section

1 "it works better because of the cosine of the angle"

1 "It works better because I can exert more force on your sled"

1 "It works better because I can exert the same amount of force more efficiently"

1 "It doesn't actually work better, I actually have to pull harder"

QUESTION 12

/8

The world record velocity for a human being travelling down a mountain on skis was sent in 2016 when Men-Ivan Origone of Italy reached a top velocity of 254.96 km/h (70.82 m/s).

Let's say that he reached the maximum velocity at the very bottom of the mountain.

PART I

1) Do a sketch of that situation showing ALL initial conditions either explicitly stated or inferred.

2) Calculate the height of his starting point down the run if we ignore the effect of air friction and friction between his skiis and the snow (we will conveniently ignore his altitude at the finish line as well). Please use FULL Wolgemuthians.

PART II

1) Let's say he lost 595 J of energy to air friction and 1215 J of energy to friction between his skis and the snow as he skied down the slope. Please add that information to your sketch.

2) Now calculate how much work the air and snow did against his motion and label that clearly on your sketch

3) Re-calculate his starting height including the friction values given in #3 of Part I above. Please use FULL Wolgemuthians once again.

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QUESTION 13

/2

I have a 3500 W generator that comes in MIGHTY handy when the power goes out:

Let's imagine that a big wind storm hits, my power goes out; and my 1250 kg car is stuck outside. I have to drag my car into my garage using a winch

powered by my generator.

Using bullet points, show each step necessary to calculate my car's velocity achieved by that generator/winch system after 5.00 seconds.

QUESTION 14

/3

Your 3rd cousin (twice removed on your mom's side) wants to drop a basketball from the 2nd story roof of your house onto your cement driveway below. Your cousin *says* that ball will bounce right back up to roof where it was dropped. You're pretty sure that's not the case. Using accurate science language, please explain to your cousin why the ball won't quite make it back to the top of the roof based on your understanding of the Law of Conservation of Energy.

QUESTION 15

/4

You just bought a brand new 1250 W hair dryer:

Let's say you use the hair dryer for 5.0 minutes every day for the month of March.

Part I:

Use a bulleted list to show how you will calculate the total amount of energy you will use to dry your hair in the month of March.

Part 2:

Continue on your bulleted list to show how high you yourself could be lifted by all that energy if we ignore air friction (Let's say your mass is 75.0Kg)

/2

QUESTION 16

In order to transform energy from one form to another: 1

Choose one option for each blank section

1. A force must act on an object
1. An object must move through the air
1. Heat must be added or taken away from the system
1. Work must be done on an object

Gig Harbor High School - PHYSICS S2: 1(A), 3(A), 6(A) **Instructors:** TONI JANOVICH, ERIC WOLGEMUTH

POSSIBLE POINTS: 35 FACTOR: X1 TEST VALUE: 35

ANSWER KEY

Work, Power & Energy - Unit Test

GRADING INSTRUCTIONS: Grade each question and tally the points to find the student's total points for the assessment. If the factor does not equal 1, multiply the total points by the factor to obtain the student's final score.

QUESTION 1: FILL IN THE BLANK DRAG AND DROP

Joules are the unit of measure for? 1 _____

Correct answers:

1 Energy

1 possible pt.

QUESTION 2: FILL IN THE BLANK DRAG AND DROP

NM are the unit of measure for? 1 _____

Correct answers:

1 Work

1 possible pt.

QUESTION 3: FILL IN THE BLANK DRAG AND DROP

Joules per second is another way of talking about 1 _____

Correct answers:

1 Power

1 possible pt.

QUESTION 4: FILL IN THE BLANK DRAG AND DROP

A Newton meter is another way to talk about 1 _____

Correct answers:

1 Energy

1 possible pt.

QUESTION 5: FILL IN THE BLANK DROPDOWN

When we are talking about force acting through a specific displacement we are talking about: 1 _____

Correct answers:

1 Work

1 possible pt.

QUESTION 6: FILL IN THE BLANK DROPDOWN

The total mechanical energy of an object falling through the air *at any m moment* can best be stated as:

1 [ ]

Correct answers:

1 Total KE at that moment + Total Ug at that moment - Total Heat Lost Up to That Moment

1 possible pt.

QUESTION 7: FILL IN THE BLANK DRAG AND DROP

The equation $\Delta KE + \Delta U_g = 0$ tells us that: 1 [ ]

Correct answers:

1 All of these options can be used to describe that formula

1 possible pt.

QUESTION 8: FILL IN THE BLANK DRAG AND DROP

The equation $\Delta KE + \Delta U_g = \pm W$ tells us that: 1

Correct answers:

1 Heat may either be added or lost in this situation

1 possible pt.

QUESTION 9: FILL IN THE BLANK DRAG AND DROP

You pull on a rope attached to a bag of cement in an attempt to drag it across your back yard. The bag of cement has a mass of 125.0 kg. You pull on that bag with a force of 517.0 N and drag it a displacement of 25.20 meters at an angle of 17.50 degrees to the horizontal.

How much work did you do pulling that bag of cement?. 1

Correct answers:

1 12,430 NM

2 possible pts.

QUESTION 10: SHORT ANSWER/ESSAY

A 17.5 kg object is dropped from the deck of the Tacoma Narrows Bridge 57.15 meters above the waters of Puget Sound. Write a bulleted list that does the following:

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Please explain to your 5 year old sister why you lowered the angle the rope makes to the ground as you pull her along. 1 [ ]

Correct answers:

1 "It works better because I can exert the same amount of force more efficiently"

2 possible pts.

QUESTION 12: FILE UPLOAD

The world record velocity for a human being travelling down a mountain on skis was sent in 2016 when Men-Ivan Origone of Italy reached a top velocity of 254.96 km/h (70.82 m/s).

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Continue on your bulleted list to show how high you yourself could be lifted by all that energy if we ignore air friction (Let's say your mass is 75.0Kg)

QUESTION 16: FILL IN THE BLANK DROPDOWN

In order to transform energy from one form to another: 1 _____

Correct answers:

1 Work must be done on an object

2 possible pts.