

PHYS 115 – 2020 Regular Final Examination

Description

This set of 1 statement of commitment to academic integrity and 15 questions is the final exam for PHYS 115 Fall 2020 at the University of Saskatchewan.

33% of the exam mark is based on the answers for the 10 multiple-choice questions submitted through WebAssign. All 10 questions are weighted equally.

67% of the exam mark is based on the answers (submitted through WebAssign) and solutions (submitted through Canvas) for the 5 word problems. All 5 word problems are weighted equally.

Instructions

Answers for **all** questions need to be submitted in WebAssign.

For each of questions 12 through 16, in addition to submitting your answers in WebAssign, write the complete solution, **including a diagram**, using the problem-solving method discussed in class.

Your solutions must use the same symbols as are used on the formulae sheet.

Formulas not on the Formulae Sheet must be derived.

Keep extra decimal places throughout your calculations, and then round-off your final answer to three significant figures.

Submit your answer to each question in WebAssign.

When you have finished the entire exam, scan your written work for questions 12 through 16 and submit a single multi-page PDF file using the link in the Canvas site for your section.

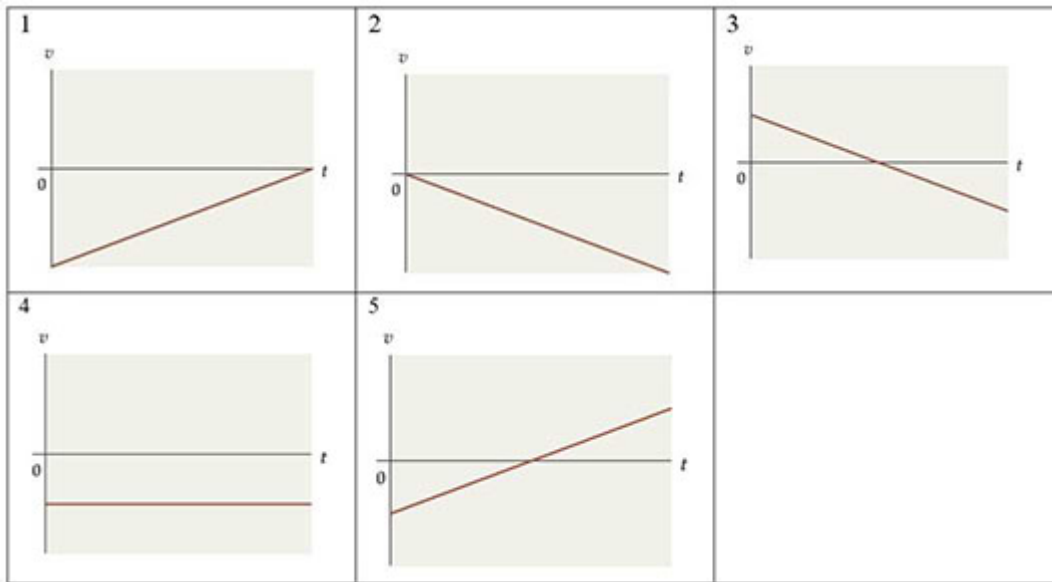
Your WebAssign submission is due no later than three hours (180 minutes) after the questions become available and your Canvas submission is due no later than three-and-a-half hours (210 minutes) after the questions become available. LATE SUBMISSIONS WILL NOT BE ACCEPTED.

1. - UofS-P115-P117-Honour [4820285]

On my honour, I pledge that I will not give or receive aid during this assessment. I understand that I am expected to complete this assessment with no communication with other persons and no resource material other than the PHYS 115/117 Formulae sheet. I recognize that it is my responsibility to uphold academic integrity and I agree to follow the rules of this assessment and the guidelines laid forth in the policies of the University of Saskatchewan. Furthermore, I fully understand that disciplinary action may be taken against me if I am discovered to have communicated with another person or to have used an internet resource.

2. - P115-FNL-2020-REG-A1 [4878736]

For an object in one-dimensional motion, which of the following velocity versus time graphs correspond to the object having a constant negative acceleration? **Select all that apply.**



- Graph 5 Graph 4 Graph 1 Graph 2 Graph 3

3. - P115-FNL-2020-REG-A2 [4878755]

You and your friend are standing 10 m apart. You throw a ball to your friend in such a way that it leaves your hand at a height of 2 m above the ground, reaches a maximum height of 3 m above the ground, and then your friend catches the ball at a height of 1.5 m above the ground. When the ball reaches its maximum height, which one of the following statements is true? You may ignore any frictional effects.

- Its velocity is zero but its acceleration is not zero.
 Its velocity is perpendicular to its acceleration.
 Its acceleration depends on the angle at which the ball was thrown.
 Its velocity is not zero, but its acceleration is zero.
 Its velocity and its acceleration are both zero.

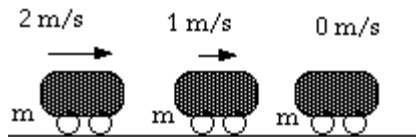
4. - P115-FNL-2020-REG-A3 [4878761]

A car accelerates from rest with a constant acceleration. Ignoring friction, when does the car require the greatest power?

- When the car first accelerates from rest
 When the car reaches half its maximum speed
 Just as the car reaches its maximum speed
 More information is needed to be able to answer the question.
 The question is misleading because the power required is constant.

5. - P115-FNL-2020-REG-A4 [4878768]

Three railroad cars, each of mass m , on a level track couple together into a single mass $3m$. Initially, two of the cars are moving at 2 m/s and 1 m/s , as shown. If they couple to the third car, which is at rest, what is the magnitude of the system's final velocity? You may ignore any effects due to friction.



- 1.0 m/s
 0.5 m/s
 3.0 m/s
 1.3 m/s
 1.5 m/s

6. - P115-FNL-2020-REG-A5 [4878769]

A child is riding on a merry-go-round which rotates without friction. Initially the child is close to the central axis of rotation of the merry-go-round. If the child moves toward the outer rim of the merry-go-round what happens to the moment of inertia of the child plus merry-go-round system and the angular speed of the merry-go-round?

- The moment of inertia decreases and the angular speed increases.
 The moment of inertia increases and the angular speed remains the same.
 The moment of inertia increases and the angular speed increases.
 The moment of inertia increases and the angular speed decreases.
 The moment of inertia decreases and the angular speed decreases.

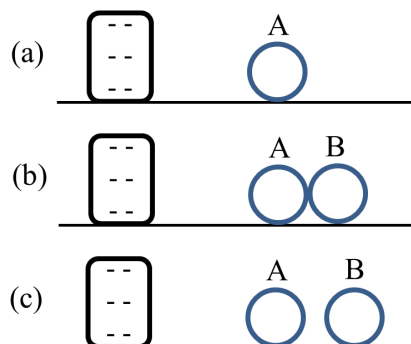
7. - P115-FNL-2020-REG-A6 [4878772]

As a planet orbits the Sun in a circular orbit centred on the Sun, how much torque does the Sun's gravitational force exert on the planet?

- $\tau = \frac{Gm_{\text{planet}}m_{\text{sun}}}{r^2}$
 $\tau = \frac{2Gm_{\text{planet}}m_{\text{sun}}}{r}$
 $\tau = \frac{Gm_{\text{planet}}m_{\text{sun}}}{2r}$
 $\tau = \frac{Gm_{\text{planet}}m_{\text{sun}}}{r}$
 $\tau = 0$

8. - P115-FNL-2020-REG-A7 [4878774]

A negatively charged object is placed on an insulating table. Then an uncharged conducting ball A is brought near to, but not touching, the negatively charged object as shown in diagram (a). Then a second uncharged conducting ball B is brought in so that it touches ball A on the side away from the negatively charged object as shown in diagram (b). Finally, ball B is moved a bit away from ball A as shown in diagram (c). The balls are moved by a person wearing an insulating glove so that none of the balls are ever grounded, and at no time do any of the balls touch the negatively charged object. Which statement is correct concerning the final charge on each ball?



- Both balls have a positive charge.
- Both ball A and ball B are not charged.
- Ball A has a negative charge and ball B has a positive charge.
- Ball A has a positive charge and ball B has a negative charge.
- Ball A has no charge and ball B has a positive charge.

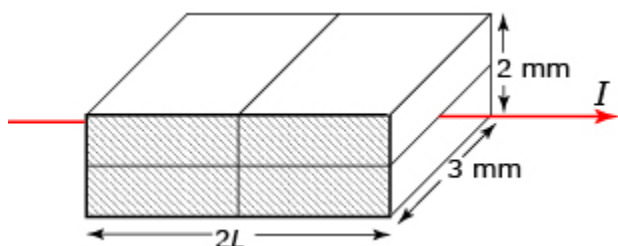
9. - P115-FNL-2020-REG-A8 [4878775]

Object A has a charge of $+2 \mu\text{C}$, and object B has a charge of $+6 \mu\text{C}$. Which one of the following statements is correct regarding the electrostatic force on each of the objects? \vec{F}_{AB} is the force on object A due to object B and \vec{F}_{BA} is the force on object B due to object A .

- $\vec{F}_{AB} = \vec{F}_{BA}$
- $\vec{F}_{AB} = -\vec{F}_{BA}$
- $\vec{F}_{AB} = -3\vec{F}_{BA}$
- $3\vec{F}_{AB} = \vec{F}_{BA}$
- $3\vec{F}_{AB} = -\vec{F}_{BA}$

10. - P115-FNL-2020-REG-A9 [4878780]

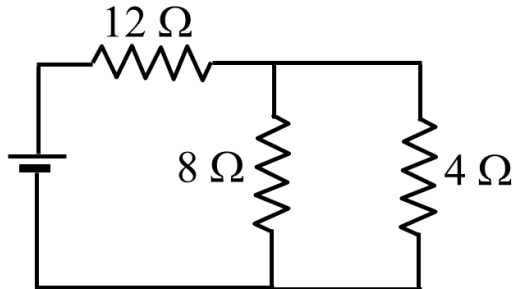
Four identical 2 ohm pieces of conducting material are fused together to make a new resistor as shown. Each original 2 ohm piece has a length L and a rectangular cross section of 1 mm x 3 mm. The new resistor has a length of $2L$ and a rectangular cross section of 2 mm x 3 mm. What is the resistance of the new resistor?



- 1 ohm
- 4 ohm
- 1/2 ohm
- 8 ohm
- 2 ohm

11. - P115-FNL-2020-REG-A10 [4878786]

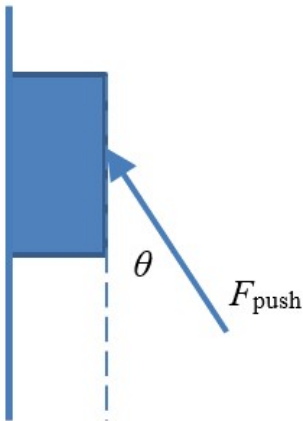
In the circuit shown the current through the $4\ \Omega$ resistance is I_4 . What is the current, I_{12} , that flows through the $12\ \Omega$ resistance?



- $I_{12} = 2 I_4$
 $I_{12} = 3 I_4$
 $I_{12} = (3/2) I_4$
 $I_{12} = (3/4) I_4$
 $I_{12} = (1/3) I_4$

12. - P115-FNL-2020-REG-B1 [4878787]

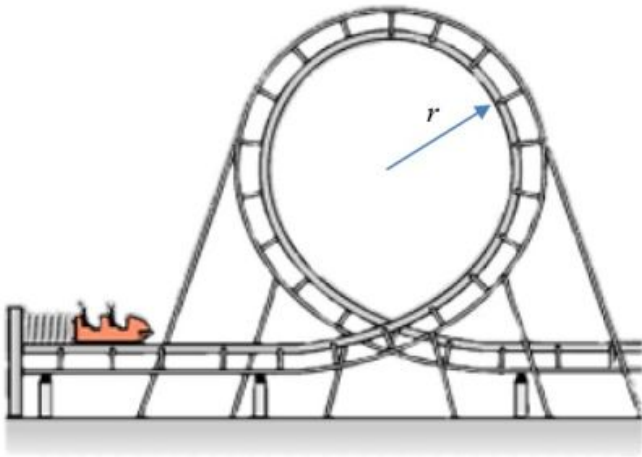
In preparation for painting a wall, you push a sanding block vertically up the wall by applying a force F_{push} at an angle θ of 29.0° as shown in the diagram. The coefficient of kinetic friction between the block and the wall is 0.828 and the mass of the block is $0.195\ \text{kg}$.



Calculate the required magnitude of F_{push} such that the block moves with constant velocity.

13. - P115-FNL-2020-REG-B2 [4878812]

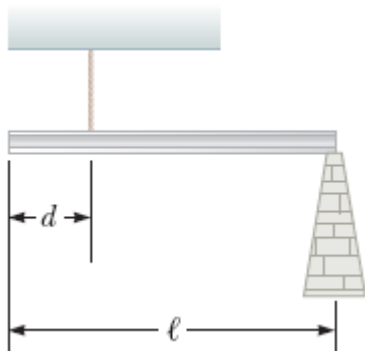
Consider the spring-loaded roller coaster shown in the figure. The car is pushed against a spring with a spring constant of 8.97×10^4 N/m such that the spring is compressed a distance x from its equilibrium (relaxed) length. The mass of the fully-loaded car is 463 kg. You may assume that the loop is circular and has a radius of 10.3 m. At its highest point, the car is a height of 21.1 m above its position when it is against the spring. Ignore all frictional effects.



- Calculate the minimum speed that the car must have at the top of the loop in order for the car to maintain contact with the track at all times (that is, so that it does not fall off the track).
- Calculate the minimum distance x that the spring must be compressed to ensure that the car does not fall off the track at the top of the loop.

14. - P115-FNL-2020-REG-B3 [4878850]

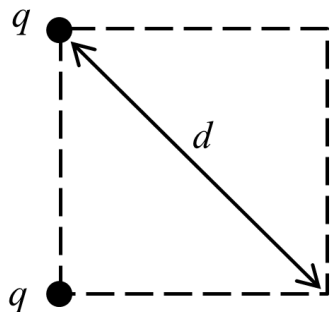
A horizontal, uniform beam with a mass of 33.5 kg and a length $\ell = 5.55$ m is suspended from a rope at a distance $d = 1.20$ m from its left end, while its right end is supported by a vertical column.



- Calculate the tension (in N) in the rope.
- Calculate the magnitude of the force (in N) that the column exerts on the right end of the beam.

15. - P115-FNL-2020-REG-B4 [4878858]

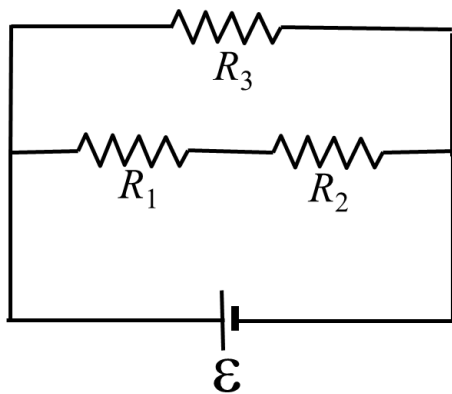
Two equal charges are placed at adjacent sides of a square as shown. The charge on each is $q = -7.73 \mu\text{C}$ and the diagonal of the square is $d = 0.442 \text{ m}$.



- (a) Calculate the electric potential (referenced to zero at infinity) at the centre of the square.
 (b) An electron is released from rest from the centre of the square. The electron moves in a vacuum so there is no friction and gravitational effects may be ignored. Calculate the kinetic energy of the electron when it is very far away from the square (i.e. an infinite distance away). Give your answer in electron volts.

16. - P115-FNL-2020-REG-B5 [4878859]

In the circuit shown, the emf \mathcal{E} of the battery is 14.8 V , and the resistances are: $R_1 = 3.14 \Omega$, $R_2 = 3.33 \Omega$, and $R_3 = 4.96 \Omega$.



- (a) Calculate the total current drawn from the battery.
 (b) Calculate the power delivered to the resistance R_3 .