Physics Honors Midterm Review (Regents Exam June 2019)

1 Which pair of quantities represent scalar quantities?

(1) displacement and velocity
(2) displacement and time
(3) energy and velocity
(4) energy and time

2 A sailboat on a lake sails 40. meters north and then sails 40. meters due east. Compared to its starting position, the new position of the sailboat is

(1) 40. m due east
(2) 40. m due north
(3) 57 m northeast
(4) 80. m northeast

3 A ball is thrown straight upward from the surface of Earth. Which statement best describes the ball's velocity and acceleration at the top of its flight?

(1) Both velocity and acceleration are zero.
(2) Velocity is zero and acceleration is nonzero.
(3) Velocity is nonzero and acceleration is zero.
(4) Both velocity and acceleration are not zero.

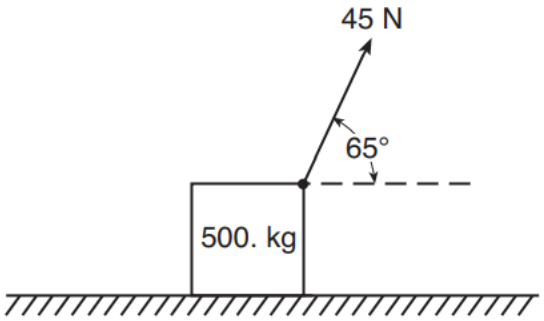
5 How would the mass and weight of an object on the Moon compare to the mass and weight of the same object on Earth?

(1) Mass and weight would both be less on the Moon.
(2) Mass would be the same but its weight would be less on the Moon.
(3) Mass would be less on the Moon and its weight would be the same.
(4) Mass and weight would both be the same on the Moon.

6 An object is moving with constant speed in a circular path. The object's centripetal acceleration remains constant in

(1) magnitude, only
(2) direction, only
(3) both magnitude and direction
(4) neither magnitude nor direction

7 As shown in the diagram below, a rope attached to a 500.-kilogram crate is used to exert a force of 45 newtons at an angle of 65 degrees above the horizontal.



The horizontal component of the force acting on the crate is

(1) 19 N
(2) 41 N
(3) 210 N
(4) 450 N

8 A spring with a spring constant of 68 newtons per meter hangs from a ceiling. When a 12-newton downward force is applied to the free end of the spring, the spring stretches a total distance of

(1) 0.18 m
(2) 0.59 m
(3) 5.7 m
(4) 820 m

9 As a student walks downhill at constant speed, his gravitational potential energy

(1) increases and his kinetic energy increases
(2) increases and his kinetic energy remains the same
(3) decreases and his kinetic energy increases
(4) decreases and his kinetic energy remains the same

10 When 150 joules of work is done on a system by an external force of 15 newtons in 20. seconds, the total energy of that system increases by

(1) 1.5×10^2 J
(2) 2.0×10^2 J
(3) 3.0×10^2 J
(4) 2.3×10^3 J

11 A person on a ledge throws a ball vertically downward, striking the ground below the ledge with 200 joules of kinetic energy. The person then throws an identical ball vertically upward at the same initial speed from the same point. What is the kinetic energy of the second ball when it hits the ground? [Neglect friction.]

(1) 200 J
(2) 400 J
(3) less than 200 J
(4) more than 400 J

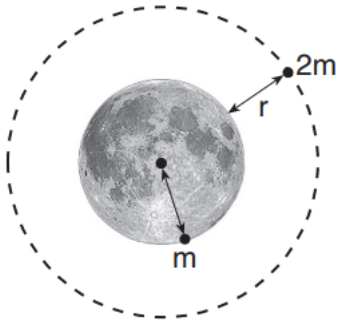
12 Two construction cranes are used to lift identical 1200-kilogram loads of bricks the same vertical distance. The first crane lifts the bricks in 20. seconds and the second crane lifts the bricks in 40. seconds. Compared to the power developed by the first crane, the power developed by the second crane is

(1) the same
(2) twice as great
(3) half as great
(4) four times as great

18 A 40.0-kilogram child exerts a 100.-newton force on a 50.0-kilogram object. The magnitude of the force that the object exerts on the child is

(1) 0.0 N
(2) 80.0 N
(3) 100. N
(4) 125 N

36 As represented in the diagram below, an object of mass m, located on the surface of the Moon, is attracted to the Moon with a gravitational force, F.

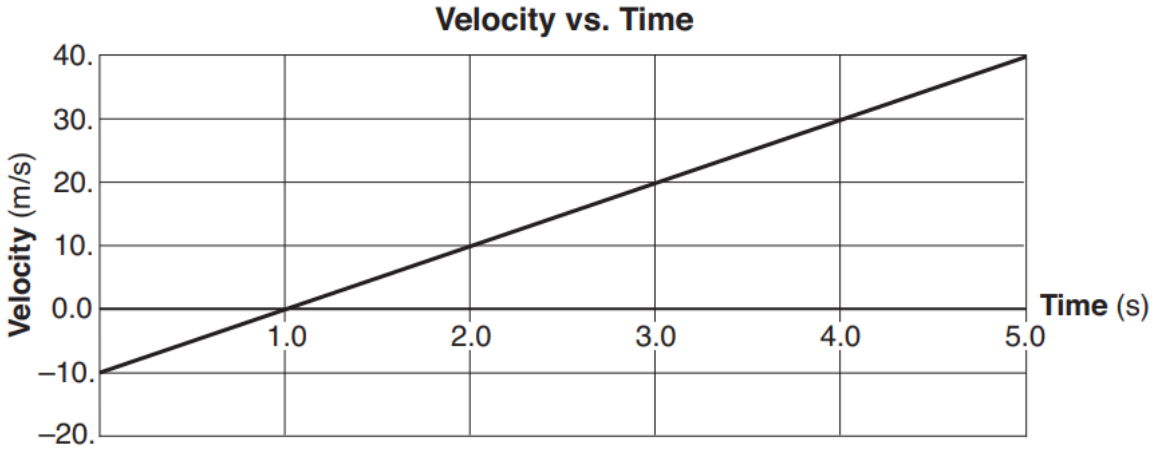


(Not drawn to scale)

An object of mass $2m$, at an altitude equal to the Moon's radius, r, above the surface of the Moon, is attracted to the Moon with a gravitational force of

(1) F
(2) $2F$
(3) $F/2$
(4) $F/4$

37 The graph below represents the relationship between velocity and time for an object moving along a straight line.



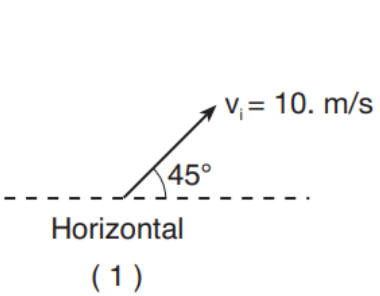
What is the magnitude of the object's acceleration?

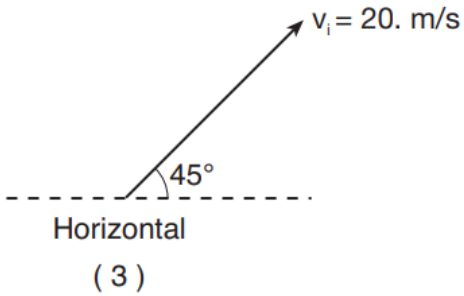
(1) 5.0 m/s^2
(2) 8.0 m/s^2
(3) 10. m/s^2
(4) 20. m/s^2

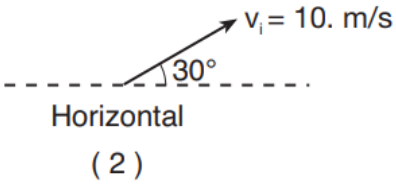
39 A 1.47-newton baseball is dropped from a height of 10.0 meters and falls through the air to the ground. The kinetic energy of the ball is 12.0 joules the instant before the ball strikes the ground. The maximum amount of mechanical energy converted to internal energy during the fall is

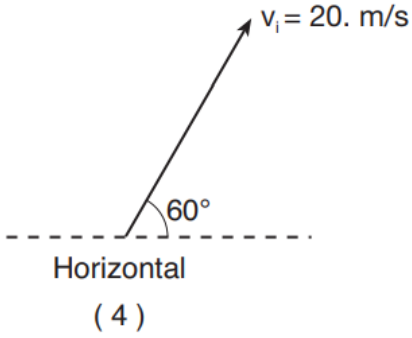
(1) 2.7 J
(2) 12.0 J
(3) 14.7 J
(4) 26.7 J

40 A projectile lands at the same height from which it was launched. Which initial velocity will result in the greatest horizontal displacement of the projectile? [Neglect friction.]





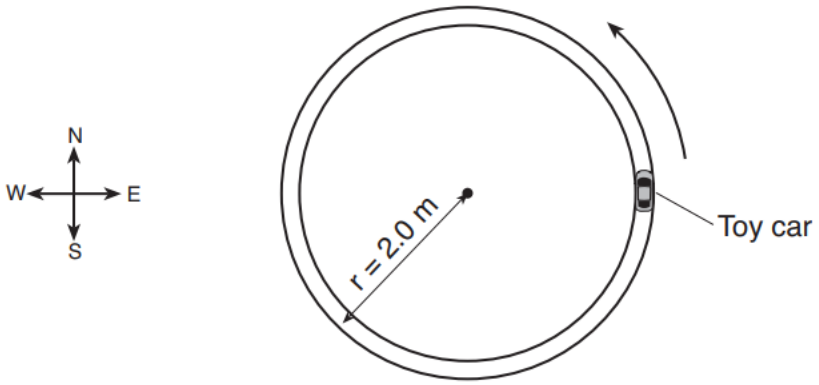




41 A 5.0-kilogram box is sliding across a level floor. The box is acted upon by a force of 27 newtons east and a frictional force of 17 newtons west. What is the magnitude of the acceleration of the box?

(1) 0.50 m/s^2
(2) 2.0 m/s^2
(3) 8.8 m/s^2
(4) 10. m/s^2

42 The diagram below represents a 2.0-kilogram toy car moving at a constant speed of 3.0 meters per second counterclockwise in a circular path with a radius of 2.0 meters.



At the instant shown in the diagram, the centripetal force acting on the car is

(1) 4.5 N north
(2) 4.5 N west
(3) 9.0 N north
(4) 9.0 N west

A toy launcher that is used to launch small plastic spheres horizontally contains a spring with a spring constant of 50. newtons per meter. The spring is compressed a distance of 0.10 meter when the launcher is ready to launch a plastic sphere.

51 Determine the elastic potential energy stored in the spring when the launcher is ready to launch a plastic sphere. [1]

52-53 The spring is released and a 0.10-kilogram plastic sphere is fired from the launcher. Calculate the maximum speed with which the plastic sphere will be launched. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

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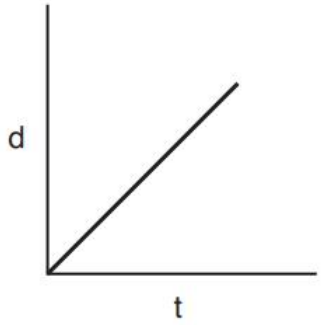
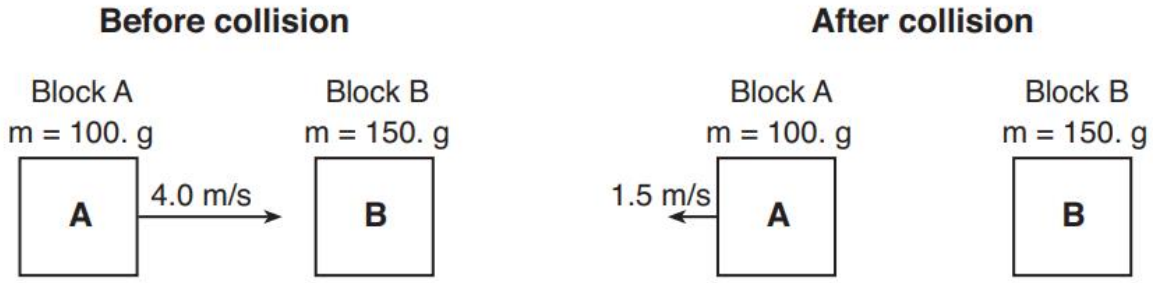
55 The graph below shows the relationship between distance, d, and time, t, for a moving object.



On the axes *in your answer booklet*, sketch the general shape of the graph that shows the relationship between the magnitude of the velocity, v, and time, t, for the moving object. [1]

59–60 A student wishes to record a 7.5-kilogram watermelon colliding with the ground. Calculate how far the watermelon must fall freely from rest so it would be traveling at 29 meters per second the instant it hits the ground. [Show all work, including the equation and substitution with units.] [2]

61-62 As represented in the diagram below, block *A* with a mass of 100. grams slides to the right at 4.0 meters per second and hits stationary block *B* with a mass of 150. grams. After the collision, block *B* slides to the right and block *A* rebounds to the left at 1.5 meters per second. [Neglect friction.]



Calculate the speed of block *B* after the collision. [Show all calculations, including the equation and substitution with units.] [2]

A 1.20×10^3-kilogram car is traveling east at 25 meters per second. The brakes are applied and the car is brought to rest in 5.00 seconds.

63-64 Calculate the magnitude of the total impulse applied to the car to bring it to rest. [Show all work, including the equation and substitution with units.] [2]

65 State the direction of the impulse applied to the car. [1]