

Name

RELEASED FORM

Physics

Form B

B

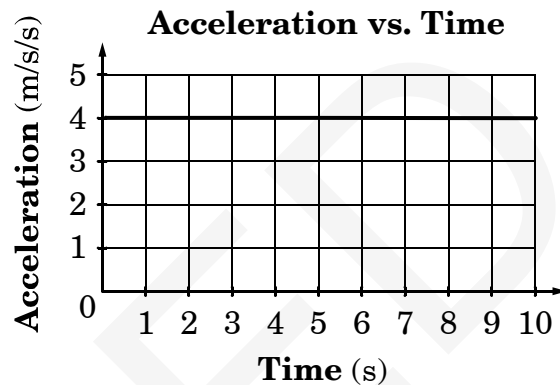
North Carolina Test of Physics

Public Schools of North Carolina
www.ncpublicschools.org
State Board of Education
Department of Public Instruction
Division of Accountability Services/North Carolina Testing Program
Raleigh, North Carolina 27699-6314



1. An object is launched across a room. How can a student determine the average horizontal velocity of the object using a meter stick and a calculator?
 - A The student can calculate the object's initial potential energy and then calculate the velocity from conservation of energy principle.
 - B The student can measure the recoil distance of the throwing mechanism and then calculate the velocity from conservation of momentum principle.
 - C The student can measure the horizontal travel distance, compute the flight time from the vertical drop, and then calculate the average horizontal velocity.
 - D The student can measure the fall distance and the travel time from the horizontal displacement and then calculate the average horizontal velocity.

2. The graph shows the acceleration of a car over time.

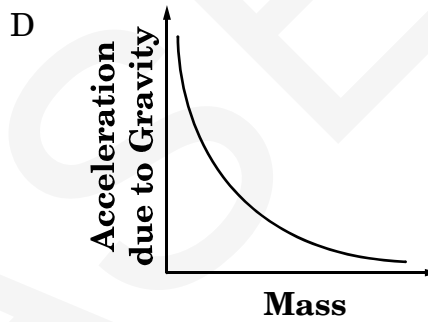
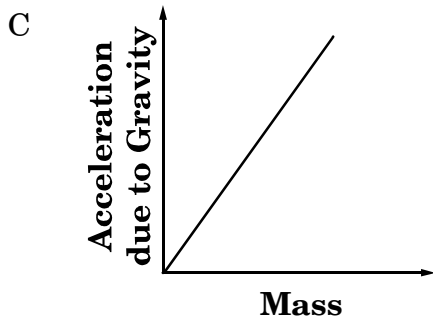
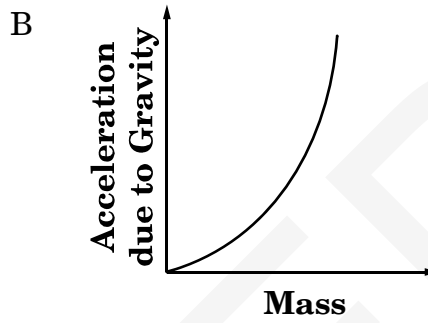
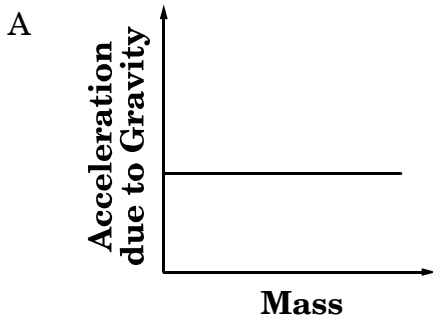


If the car starts from rest, what is the velocity of the car after 5.0 seconds?

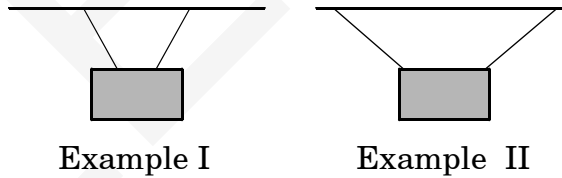
- A 0 m/s
- B 0.80 m/s
- C 4.0 m/s
- D 20. m/s

3. A car travels at a constant speed on a flat, circular track. Which factor, when doubled, will decrease the centripetal force on the car?
- A mass of the car
 - B weight of the car
 - C velocity of the car
 - D radius of the track
4. Neglecting air resistance, if a ball is thrown 4.5 m/s horizontally from a 94-m cliff, how far has the ball fallen after 2.7 s?
- A 36 m
 - B 48 m
 - C 58 m
 - D 71 m

5. Which graph represents the relationship between the gravitational acceleration of a falling body and the mass of the body?



6. These diagrams represent two examples of signs hanging from identical ropes.



Which example would most likely be able to support the *heaviest* sign?

- A example I, because the ropes exert the greatest horizontal force on the sign
- B example II, because the ropes exert the greatest horizontal force on the sign
- C example I, because the ropes exert the greatest vertical force on the sign
- D example II, because the ropes exert the greatest vertical force on the sign

7. A horizontal force acts on a block sliding on a horizontal surface. The force of kinetic friction between the block and the surface is $0.5F$. If the direction of the applied force is reversed, which is true?
- A The magnitude of the net force on the block increases.
 - B The magnitude of the acceleration of the block remains the same.
 - C The kinetic energy of the block increases.
 - D The velocity of the block remains the same.
8. A rope horizontally pulls a massive object lying on a surface with friction with a constant velocity. What describes the force on the rope?
- A equal to the frictional force
 - B greater than the frictional force
 - C equal to the weight of the object
 - D greater than the weight of the object
9. What is the difference in momentum between a 53-kg athlete running 3.58 m/s and a 880.-kg car traveling 1.03 m/s?
- A 130 kg • m/s
 - B 720 kg • m/s
 - C 1,100 kg • m/s
 - D 2,100 kg • m/s
10. A 13-N east horizontal force acts in the same direction as a 6.4-kg block as it slides 2.5 m/s on a frictionless, horizontal surface for 2.1 s. What is the speed of the block after force is applied?
- A 1.7 m/s
 - B 4.3 m/s
 - C 6.7 m/s
 - D 7.2 m/s

11. The chart represents the work output and the time to do the work for four machines.

Machine	Work (J)	Time(s)
I	1	1
II	1	4
III	4	2
IV	4	0.5

For which machine is the power output least?

- A I
- B II
- C III
- D IV

12. A 290-N force is used to compress a spring. The spring constant of the spring is 5,880 N/m. How far is the spring compressed?

- A 0.0050 m
- B 0.049 m
- C 0.31 m
- D 20. m

13. Figure 1 represents a pendulum. Figure 2 represents the motion of the pendulum as a wave. Points Z and W are the highest positions of the swinging mass. Point Y is halfway between points X and Z.

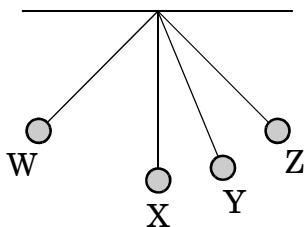


Figure 1

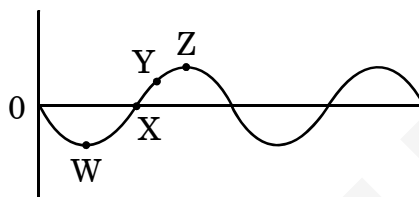
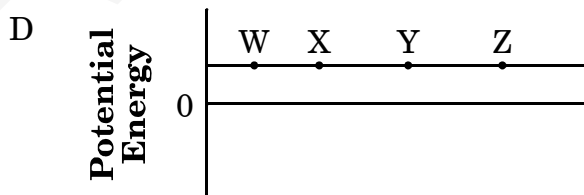
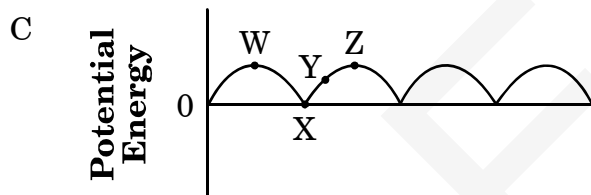
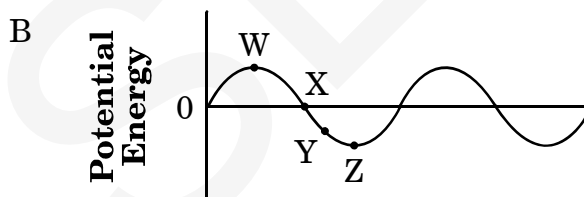
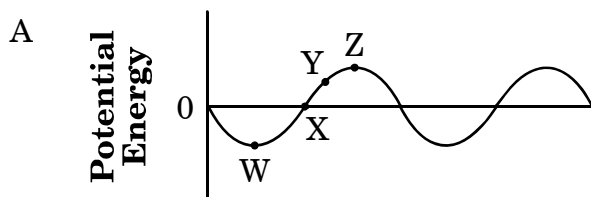


Figure 2

Which graph represents the potential energy of the swinging mass at different points?



14. What is the maximum velocity at which a 25-W motor can lift a 8.5-kg object upward?

- A 0.30 m/s
- B 2.9 m/s
- C 7.6 m/s
- D 29 m/s

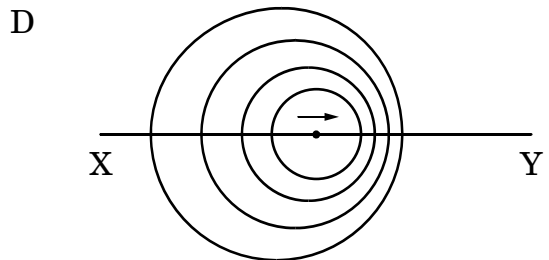
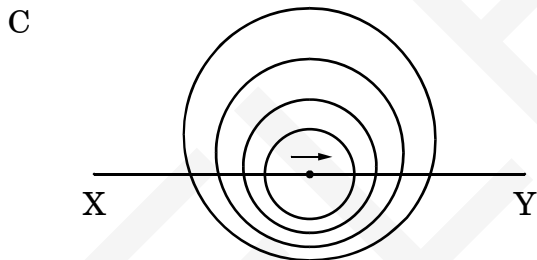
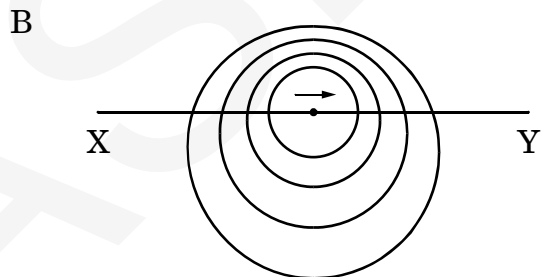
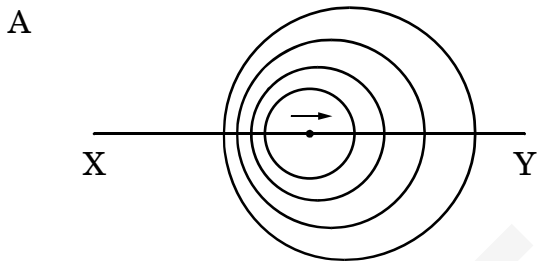
15. What is the frequency of a wave with a speed of 10 m/s and wavelength of 20 m?

- A 0.5 Hz
- B 2 Hz
- C 30 Hz
- D 200 Hz

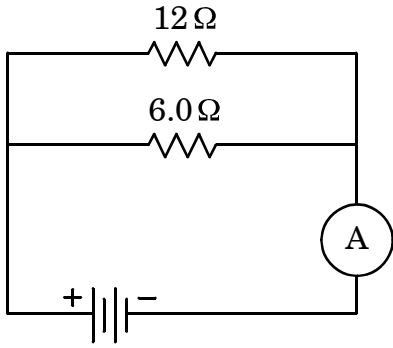
16. The frequency of a wave is 5.1×10^{14} Hz. The speed of a wave in a certain medium is 2.1×10^8 m/s. What is the index of refraction of the medium?

- A 0.41
- B 0.73
- C 1.4
- D 2.4

17. An object produces a sound with constant frequency as the object moves from X to Y. Which diagram represents the pattern of the sound?



18. The diagram represents a DC circuit.



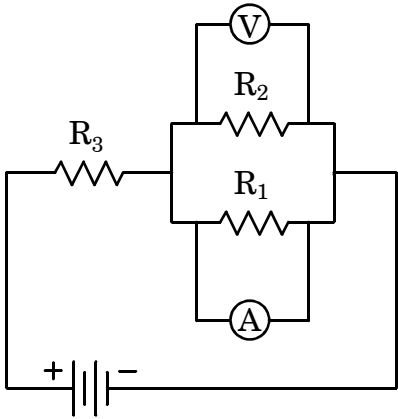
What is the voltage of the battery when the ammeter reads 4.0 amperes?

- A 0.22 V
- B 1.0 V
- C 4.5 V
- D 16 V

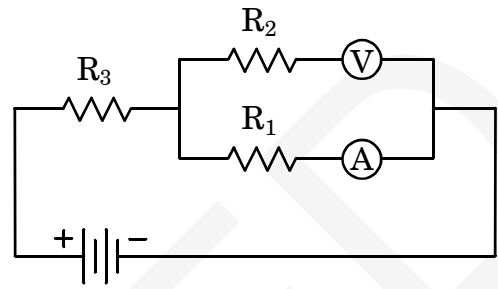
19. A student combs his hair with a plastic comb, and the hair becomes positively charged. What is the net charge of the comb and the hair and the direction of the charge transfer?
- A Protons move from the comb to the hair, and the total charge of the hair and the comb is zero.
 - B Electrons move from the hair to the comb, and the total charge of the hair and the comb is zero.
 - C Protons move from the comb to the hair, and the total charge of the hair and the comb is positive.
 - D Electrons move from the hair to the comb, and the total charge of the hair and the comb is negative.

20. A student wants to measure the current flowing through and the voltage across R_1 in the circuit. Which configuration is correct?

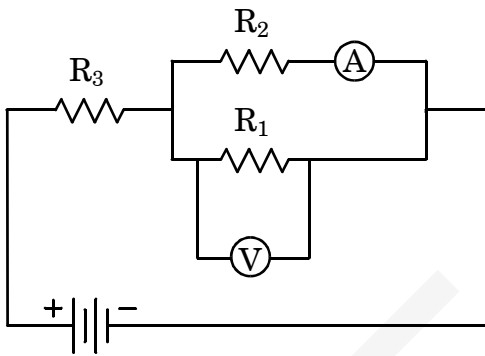
A



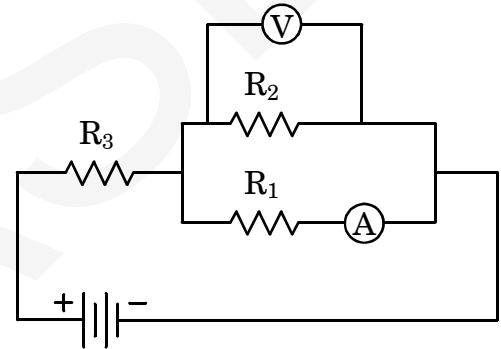
B



C



D



21. Item not scored.

A

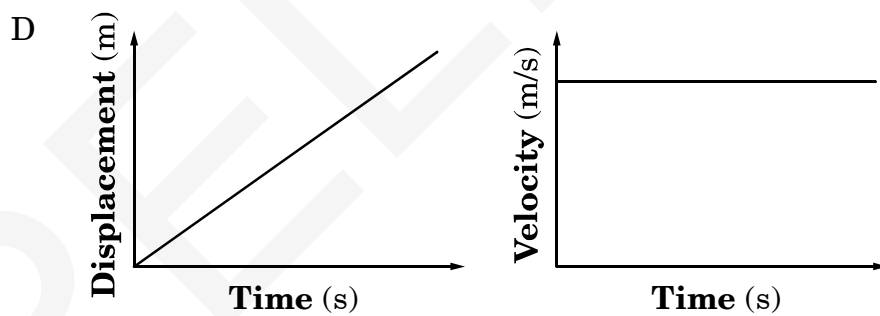
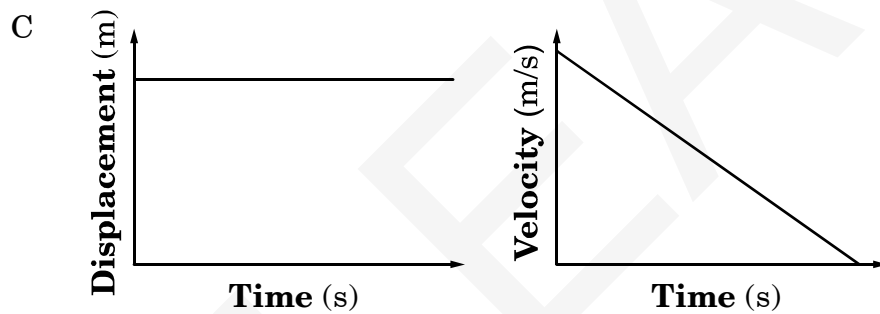
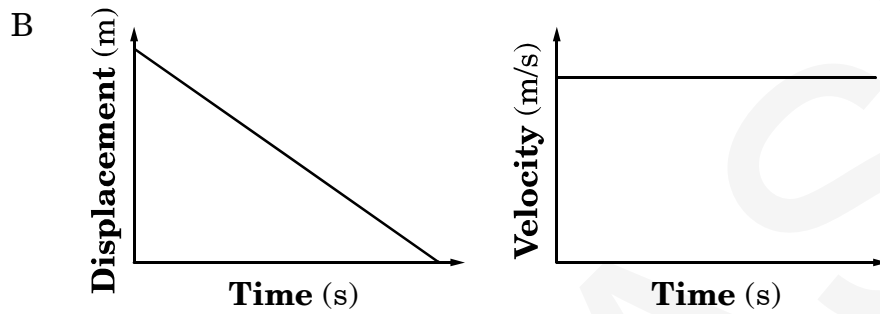
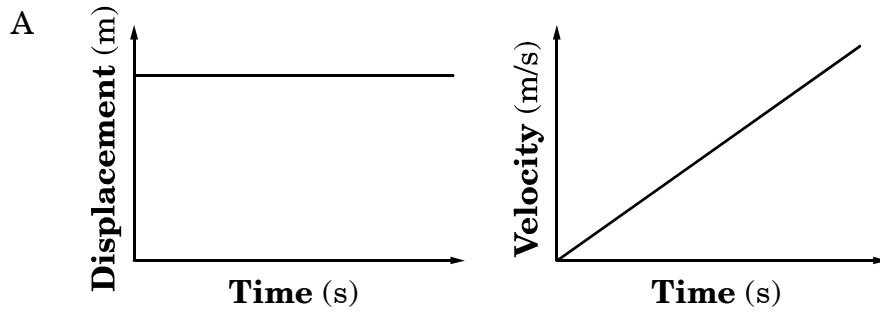
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C

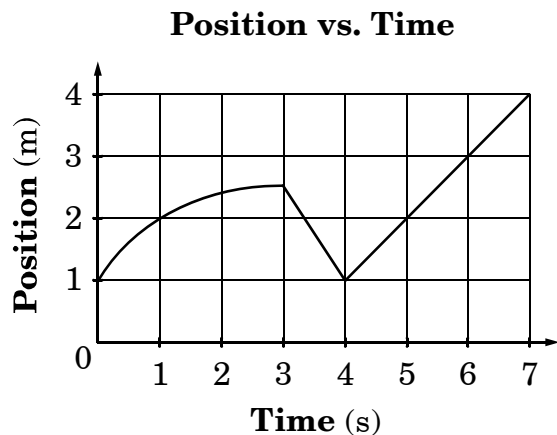
D

22. An athlete running 2.6 m/s increases his velocity to 3.7 m/s in 2.7 s. What is the acceleration of the runner?
- A 0.41 m/s/s
 - B 1.2 m/s/s
 - C 1.4 m/s/s
 - D 2.3 m/s/s

23. Which pair of graphs represent the correct relationship between displacement and the velocity of a moving object?



24. The graph represents the position of a cart as a function of time.



What is the velocity at 6 seconds?

- A 0.33 m/s
 - B 0.43 m/s
 - C 0.50 m/s
 - D 1.0 m/s
25. An object travels around a 120-m radius circular path at a constant 70 m/s. The centripetal force on the object is 3.5×10^4 N. What is the mass of the object?
- A 4.17×10^0 kg
 - B 8.57×10^2 kg
 - C 6.00×10^4 kg
 - D 1.43×10^6 kg

26. A boat moves 2.5 m/s north across a river flowing 1.2 m/s east. What is the speed of the boat relative to the shore?

- A 1.3 m/s
- B 2.2 m/s
- C 2.5 m/s
- D 2.8 m/s

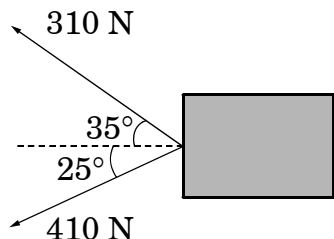
27. A ball is thrown with a velocity of 12.0 m/s at an angle 30.0° above horizontal. Ignoring air resistance, what is the ball's vertical component of velocity?

- A 6.00 m/s
- B 6.93 m/s
- C 10.4 m/s
- D 20.8 m/s

28. A student pushes a 35-kg block on a frictionless, horizontal surface with a horizontal force of 18 N. If the block is initially at rest, what is the speed of the block after the student pushes the block 20.1 m?

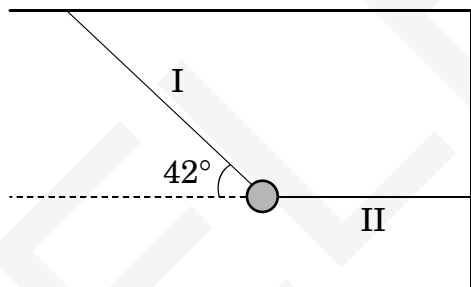
- A 2.3 m/s
- B 4.5 m/s
- C 6.3 m/s
- D 21 m/s

29. The diagram represents a block with two applied forces.



Ignoring friction, how much force pulls the object to the left?

- A 120 N
 - B 350 N
 - C 620 N
 - D 720 N
30. This diagram represents a 1.9-kg object in static equilibrium hanging from two strings, I and II.



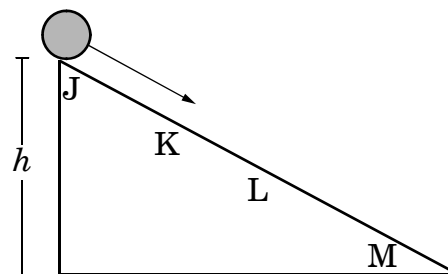
What is the force on string II?

- A 28 N
- B 21 N
- C 19 N
- D 17 N

31. A 3.0×10^3 -kg truck traveling at 20.0 m/s in a test laboratory collides into a wall and comes to rest in 0.10 s. What is the magnitude of the average force acting on the truck during the collision?

- A 1.5×10^1 N
- B 1.5×10^3 N
- C 6.0×10^3 N
- D 6.0×10^5 N

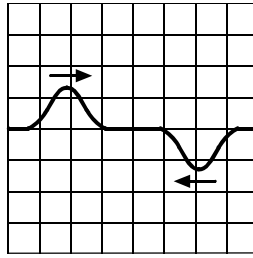
32. A ball is released from the top of an inclined plane as shown below. Ignoring friction, where will the potential energy (PE) and kinetic energy (KE) of the ball be at a maximum?



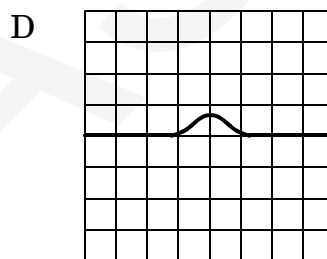
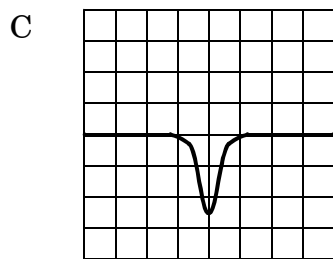
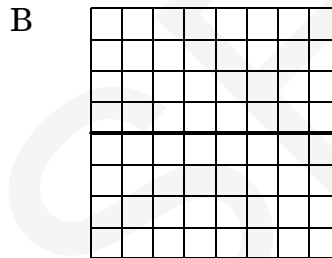
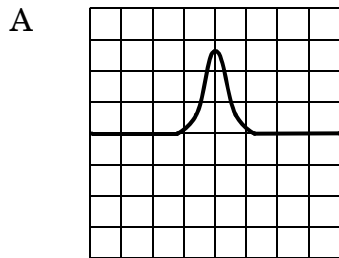
- A PE at J, KE at M
- B PE at K, KE at L
- C PE at L, KE at K
- D PE at M, KE at J

33. A 588-N person carrying 294 N of equipment starts climbing a mountain that is 3,118 m high. What is the minimum energy required for the person to climb the mountain?
- A 2.81×10^5 J
B 9.17×10^5 J
C 1.83×10^6 J
D 2.75×10^6 J
34. A machine lifts a 35-kg object 20.0 m in 2.0 s. How much power is produced by the machine to lift the object?
- A 350 W
B 890 W
C 3,400 W
D 6,900 W
35. A student throws an object downward. The initial kinetic energy of the object is 360 J. When the object reaches the ground, the kinetic energy of the object is 3 times the initial kinetic energy of the object. What was the initial potential energy of the object?
- A 360 J
B 720 J
C 1,100 J
D 1,400 J

36. The diagram represents two pulses moving toward each other on a rope.



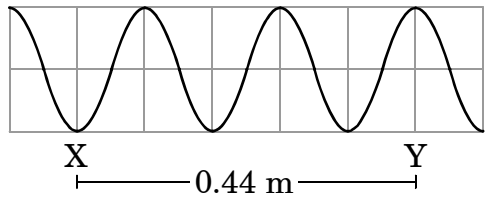
What occurs when the pulses meet?



37. A light ray traveling through air is incident on a pool of water. If the light has an angle of incidence of 30.6° , what is the angle of refraction in the water?

- A 22.5°
- B 30.6°
- C 42.6°
- D 48.8°

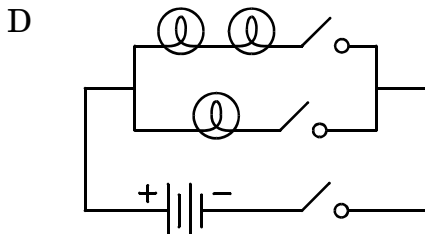
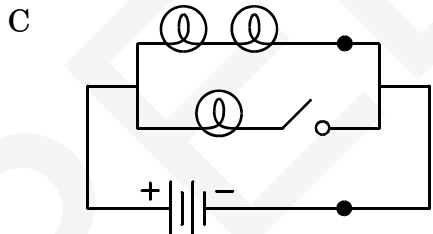
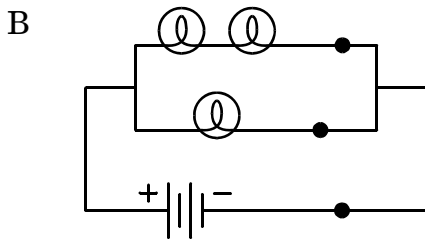
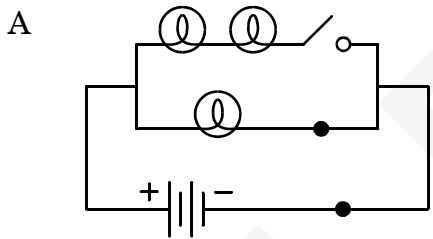
38. This diagram represents a wave.



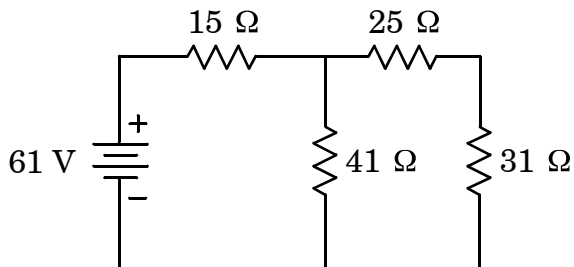
If each point on the wave takes 0.020 s to travel from X to Y, what is the period of the wave?

- A 0.0080 s
- B 0.045 s
- C 0.18 s
- D 0.26 s

39. If all bulbs and power sources shown are identical, which circuit contains only 2 lit bulbs?



40. The diagram represents a DC circuit.



What is the total resistance of the circuit?

- A 25 Ω
- B 28 Ω
- C 39 Ω
- D 58 Ω

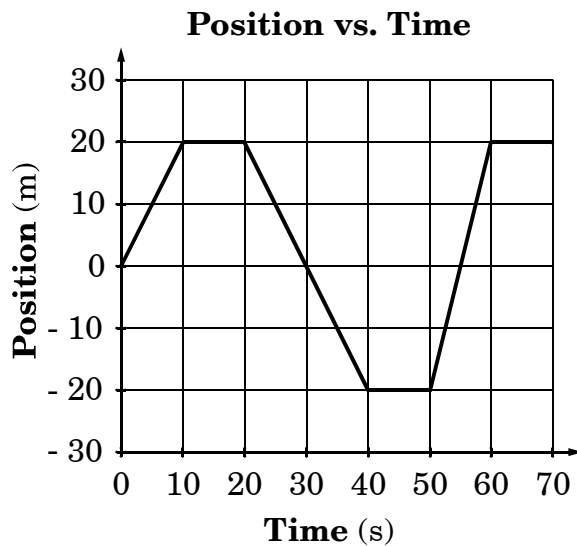
41. Two charged particles are 0.080 m apart. They are moved until the force between them is 16 times greater. How far apart are the charges?

- A 0.0050 m
- B 0.020 m
- C 0.040 m
- D 0.16 m

42. Drag the label to the correct position on the diagram to identify normal force on the block.

- A
- B
- C
- D

43. The graph represents the motion of a car moving linearly.



When is the car moving backwards?

- A 0 s to 10 s
- B 20 s to 40 s
- C 40 s to 50 s
- D 50 s to 60 s

44. The average speed of a cart during a 15-s interval is 3.0 m/s. What is the total distance traveled by the cart?

- A 0.20 m
- B 5.0 m
- C 18 m
- D 45 m

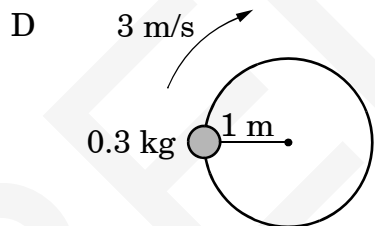
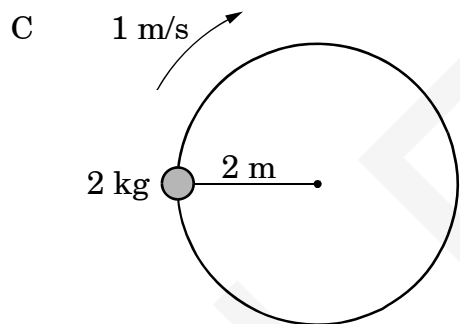
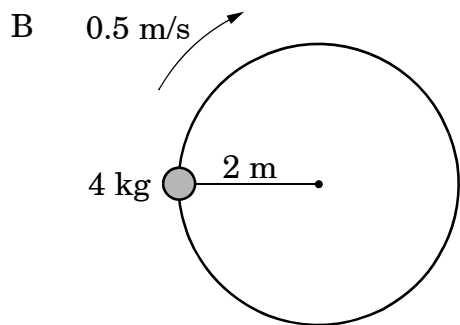
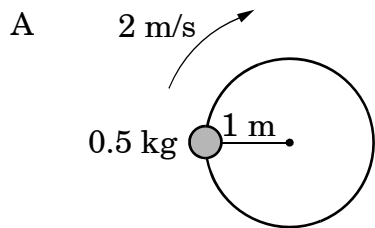
45. A car travels at 11 m/s east for 61 s, then travels at 25 m/s east for 31 s. What is the average velocity of the car?

- A 8.5 m/s east
- B 16 m/s east
- C 18 m/s east
- D 36 m/s east

46. An object moves in uniform circular motion, and the centripetal force on the object is 4.0 N. If the mass of the object decreases by a factor of 2, what will be the centripetal force on the object?

- A 1.0 N
- B 2.0 N
- C 8.0 N
- D 16 N

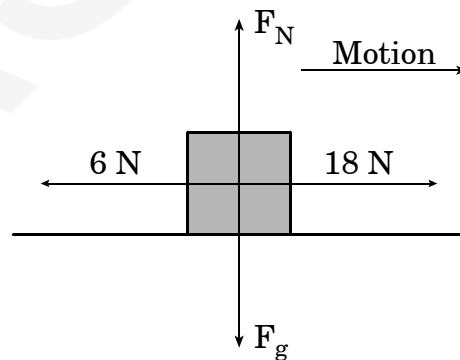
47. The objects shown are moving in a horizontal, uniform, circular motion. Which object experiences the *least* centripetal force?



48. A 730-N person pulls a rope tied to a tree. If the person pulls the rope with a force of 120 N, what is the magnitude of the reaction force on the rope?

- A 120 N
- B 610 N
- C 730 N
- D 850 N

49. The diagram represents forces acting on a block that accelerates 6.0 m/s/s on a frictionless surface.



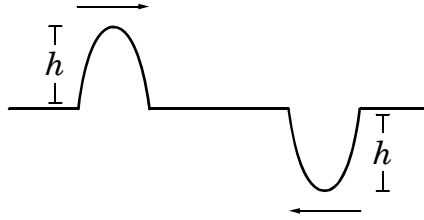
What is the mass of the block?

- A 2.0 kg
- B 4.0 kg
- C 12 kg
- D 72 kg

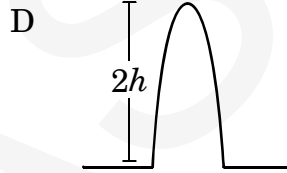
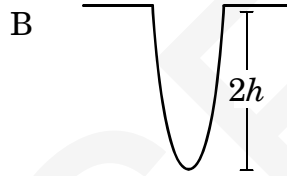
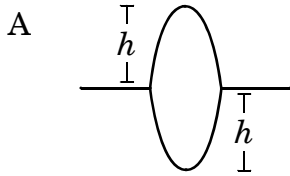
50. A 2.6-kg block rests on a plane inclined at 35° to the horizontal. What is the frictional force acting on the block?
- A 11 N
 - B 15 N
 - C 22 N
 - D 26 N
51. A 2-kg body of mass is moving on a horizontal frictionless surface with a velocity of 4 m/s. What is the net force required to keep the body moving with the same velocity and direction for 5 s?
- A 0 N
 - B 2 N
 - C 8 N
 - D 20 N
52. An object has a mass, m , and velocity, v . Which change would make its momentum become one-fourth as much?
- A Its mass becomes $\frac{m}{2}$, and its velocity becomes $\frac{v}{2}$.
 - B Its mass remains m , and its velocity becomes $\frac{v}{2}$.
 - C Its mass becomes $\frac{m}{3}$, and its velocity remains v .
 - D Its mass becomes $\frac{m}{2}$, and its velocity remains $2v$.
53. A 75-kg object traveling 15 m/s collides with and sticks to a 315-kg object initially at rest. What is the final velocity of the two objects?
- A 2.9 m/s
 - B 3.6 m/s
 - C 12 m/s
 - D 19 m/s

54. How much power is required to lift a 12-N box at 4.5 m/s?
- A 2.6 W
 - B 5.4 W
 - C 44 W
 - D 54 W
55. A student drops a 0.45-kg ball that hits the floor with a speed of 5.3 m/s. If the velocity of the ball is 4.8 m/s when it hits the floor on the second bounce, how much mechanical energy is lost during the first bounce?
- A 0 J
 - B 1.1 J
 - C 4.8 J
 - D 6.3 J
56. A pendulum swings back and forth up to a maximum height of 1.52 m. Neglecting friction, what is the speed of the pendulum at the lowest position?
- A 2.7 m/s
 - B 3.9 m/s
 - C 5.5 m/s
 - D 30. m/s

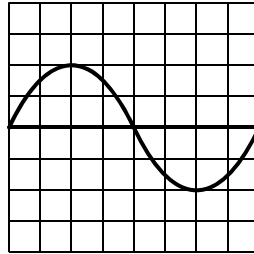
57. The diagram represents two pulses traveling toward each other.



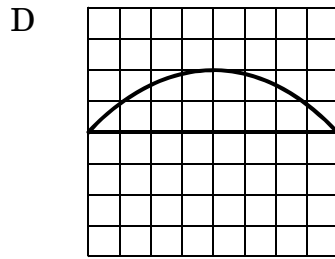
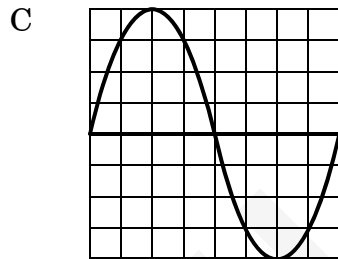
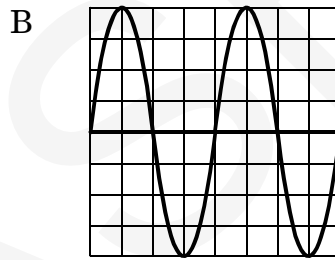
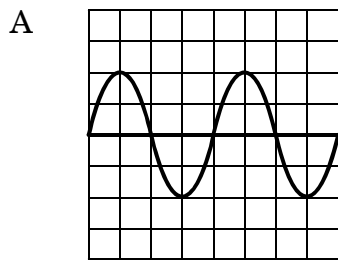
Which represents what happens when the pulses meet?



58. This graph represents a wave created by a student who hits a 220-Hz tuning fork with a certain force.

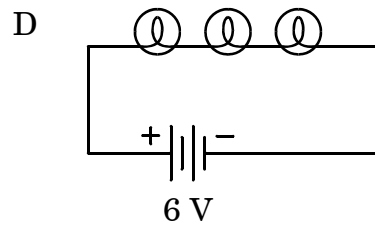
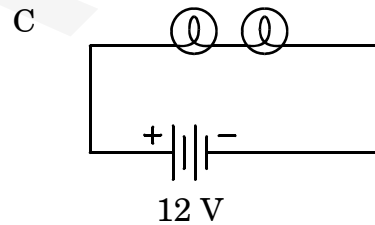
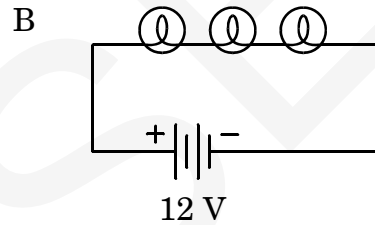
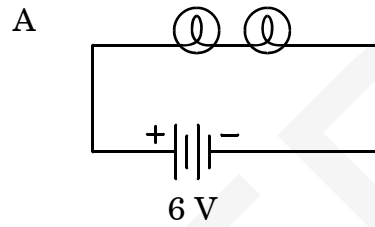


The student hits a 440-Hz tuning fork with the same force. Which graph represents the new wave?



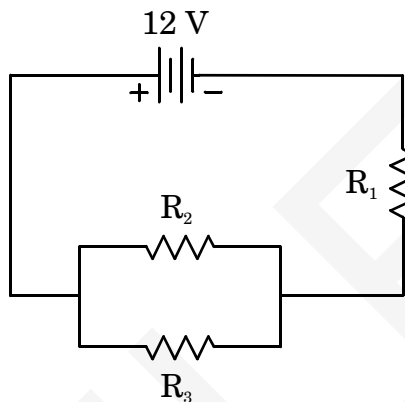
59. A student places a piece of glass over a tank of water. What happens to the speed of a light ray that shines from air through glass into the water?
- A increases in glass and water
 - B decreases in glass and water
 - C increases in glass, then decreases in water
 - D decreases in glass, then increases in water

60. In these diagrams, all light bulbs are identical. In which circuit would the light bulbs be the dimmest?



61. What happens when a positively charged rod touches a neutral metal sphere?
- A Protons move from the sphere to the rod.
 - B Protons move from the rod to the sphere.
 - C Electrons move from the sphere to the rod.
 - D Electrons move from the rod to the sphere.

62. This diagram represents a DC circuit. Each resistor has a value of 5.1Ω .



If R_3 is removed from the circuit, how much current will flow through the circuit?

- A 1.2 A
- B 1.6 A
- C 2.4 A
- D 4.8 A

63. Click and drag the pendulum to a position where the pendulum will have its maximum velocity.

- A
- B
- C
- D



End of Physics Test

**North Carolina Test of Physics
Form B RELEASED Fall 2009
Answer Key**

Item Number	Correct Answer	Goal
1	C	2 — Linear Motion
2	D	2 — Linear Motion
3	D	3 — Two Dimensional and Circular Motions
4	A	3 — Two Dimensional and Circular Motions
5	A	4 — Forces and Newton's Laws of Motion
6	C	4 — Forces and Newton's Laws of Motion
7	B	4 — Forces and Newton's Laws of Motion
8	A	4 — Forces and Newton's Laws of Motion
9	B	5 — Impulse & Momentum
10	C	5 — Impulse & Momentum
11	B	6 — Energy
12	B	6 — Energy
13	C	6 — Energy
14	A	6 — Energy
15	A	7 — Waves: Sound & Light
16	C	7 — Waves: Sound & Light
17	D	7 — Waves: Sound & Light
18	D	8 — Electricity
19	B	8 — Electricity
20	D	8 — Electricity
21	n/a	n/a
22	A	2 — Linear Motion
23	D	2 — Linear Motion
24	D	2 — Linear Motion
25	B	3 — Two Dimensional and Circular Motions
26	D	3 — Two Dimensional and Circular Motions
27	A	3 — Two Dimensional and Circular Motions
28	B	4 — Forces and Newton's Laws of Motion
29	C	4 — Forces and Newton's Laws of Motion
30	B	4 — Forces and Newton's Laws of Motion
31	D	5 — Impulse & Momentum
32	A	6 — Energy
33	D	6 — Energy
34	C	6 — Energy
35	B	6 — Energy
36	B	7 — Waves: Sound & Light
37	A	7 — Waves: Sound & Light
38	A	7 — Waves: Sound & Light
39	C	8 — Electricity
40	C	8 — Electricity
41	B	8 — Electricity
42	A	5 — Impulse & Momentum

**North Carolina Test of Physics
Form B RELEASED Fall 2009
Answer Key**

43	B	2 — Linear Motion
44	D	2 — Linear Motion
45	B	2 — Linear Motion
46	B	3 — Two Dimensional and Circular Motions
47	B	3 — Two Dimensional and Circular Motions
48	A	4 — Forces and Newton's Laws of Motion
49	A	4 — Forces and Newton's Laws of Motion
50	B	4 — Forces and Newton's Laws of Motion
51	A	4 — Forces and Newton's Laws of Motion
52	A	5 — Impulse & Momentum
53	A	5 — Impulse & Momentum
54	D	6 — Energy
55	B	6 — Energy
56	C	6 — Energy
57	C	7 — Waves: Sound & Light
58	A	7 — Waves: Sound & Light
59	D	7 — Waves: Sound & Light
60	D	8 — Electricity
61	C	8 — Electricity
62	A	8 — Electricity
63	A	6 — Energy

**North Carolina Test of Physics
Form B RELEASED Fall 2009
Raw to Scale Score Conversion**

Raw Score	Scale Score
0	117
1	118
2	118
3	119
4	120
5	120
6	121
7	122
8	122
9	123
10	124
11	125
12	126
13	127
14	127
15	128
16	129
17	130
18	131
19	133
20	134
21	135
22	136
23	137
24	138
25	139
26	140
27	141
28	142
29	142
30	143
31	144
32	145
33	146
34	147
35	148
36	148
37	149
38	150
39	151
40	151
41	152

**North Carolina Test of Physics
Form B RELEASED Fall 2009
Raw to Scale Score Conversion**

42	153
43	154
44	154
45	155
46	156
47	157
48	158
49	158
50	159
51	160
52	161
53	162
54	163
55	164
56	165
57	166
58	168
59	169
60	171
61	174
62	176