Name

Regents Review: Level ~~Two~~ Three

Equations and Skills

398. A roller coaster, traveling with an initial speed of 15 meters per second, decelerates uniformly at –7.0 meters per second^2 to a full stop. Approximately how far does the roller coaster travel during its deceleration?

A) 1.0 m B) 2.0 m
C) 16 m D) 32 m

399. A book of mass *m* falls freely from rest to the floor from the top of a desk of height *h*. What is the speed of the book upon striking the floor?

A) $\sqrt{2gh}$ B) $2gh$
C) mgh D) mh

400. A ball is thrown straight downward with a speed of 0.50 meter per second from a height of 4.0 meters. What is the speed of the ball 0.70 second after it is released? [Neglect friction.]

A) 0.50 m/s B) 7.4 m/s
C) 9.8 m/s D) 15 m/s

401. A 5.0-kilogram sphere, starting from rest, falls freely 22 meters in 3.0 seconds near the surface of a planet. Compared to the acceleration due to gravity near Earth's surface, the acceleration due to gravity near the surface of the planet is approximately

A) the same
B) twice as great
C) one-half as great
D) four times as great

402. A rock falls from rest a vertical distance of 0.72 meter to the surface of a planet in 0.63 second. The magnitude of the acceleration due to gravity on the planet is

A) 1.1 m/s^2 B) 2.3 m/s^2
C) 3.6 m/s^2 D) 9.8 m/s^2

403. Starting from rest, object *A* falls freely for 2.0 seconds, and object *B* falls freely for 4.0 seconds. Compared with object *A*, object *B* falls

A) one-half as far
B) twice as far
C) three times as far
D) four times as far

404. A laboratory cart with a mass of 5 kilograms rolls through a distance of 2 meters in 10 seconds. Which of the following mathematical statements can be used to determine the momentum?

A) 5 kg × 2m/10s B) 5 kg × 10s/2m
C) 5kg + 2m/10s D) 5 kg + 10s/2m

405. A motorcycle being driven on a dirt path hits a rock. Its 60.-kilogram cyclist is projected over the handlebars at 20. meters per second into a haystack. If the cyclist is brought to rest in 0.50 second, the magnitude of the average force exerted on the cyclist by the haystack is

A) 6.0×10^1 N B) 5.9×10^2 N
C) 1.2×10^3 N D) 2.4×10^3 N

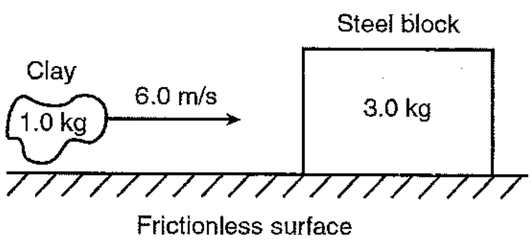
406. A 6.0-kilogram block, sliding to the east across a horizontal, frictionless surface with a momentum of 30. kilogram•meters per second, strikes an obstacle. The obstacle exerts an impulse of 10. newton•seconds to the west on the block. The speed of the block after the collision is (Skill 20)

A) 1.7 m/s
B) 3.3 m/s
C) 5.0 m/s
D) 20. m/s

407. A 2.0-kilogram laboratory cart is sliding across a horizontal frictionless surface at a constant velocity of 4.0 meters per second east. What will be the cart's velocity after a 6.0-newton westward force acts on it for 2.0 seconds? (Skill 20)

A) 2.0 m/s east
B) 2.0 m/s west
C) 10. m/s east
D) 10. m/s west

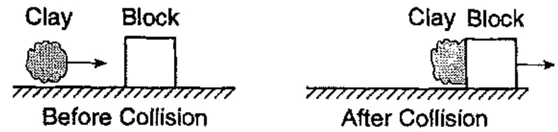
408. A 3.0-kilogram steel block is at rest on a friction-less horizontal surface. A 1.0-kilogram lump of clay is propelled horizontally at 6.0 meters per second toward the block as shown in the diagram below.



Upon collision, the clay and steel block stick together and move to the right with a speed of (Skill 27)

A) 1.5 m/s
B) 2.0 m/s
C) 3.0 m/s
D) 6.0 m/s

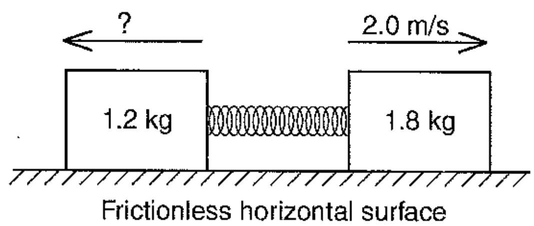
409. As shown in the diagrams below, a lump of clay travels horizontally to the right toward a block at rest on a frictionless surface. Upon collision, the clay and the block stick together and move to the right.



Compared to the total momentum of the clay and the block before the collision, the momentum of the clay-block system after the collision is (Skill 27)

A) less
B) greater
C) the same

410. A 1.2-kilogram block and a 1.8-kilogram block are initially at rest on a frictionless, horizontal surface. When a compressed spring between the blocks is released, the 1.8-kilogram block moves to the right at 2.0 meters per second, as shown.



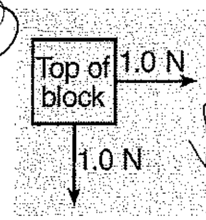
What is the speed of the 1.2-kilogram block after the spring is released? (Skill 26)

A) 1.4 m/s
B) 2.0 m/s
C) 3.0 m/s
D) 3.6 m/s

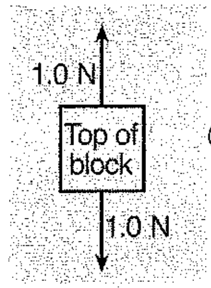
411. A rock is thrown straight up into the air. At the highest point of the rock's path, the magnitude of the net force acting on the rock is (Skill 15)

A) less than the magnitude of the rock's weight, but greater than zero
B) greater than the magnitude of the rock's weight
C) the same as the magnitude of the rock's weight
D) zero

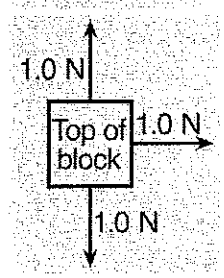
412. A number of 1.0-newton horizontal forces are exerted on a block on a frictionless, horizontal surface. Which top-view diagram shows the forces producing the greatest magnitude of acceleration of the block? (Skill 21)

A)


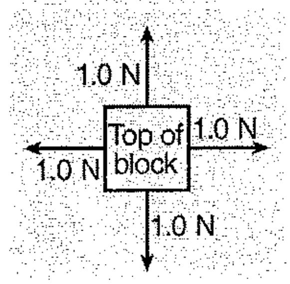
$\sqrt{2}$N = 1.4N

B)


0N

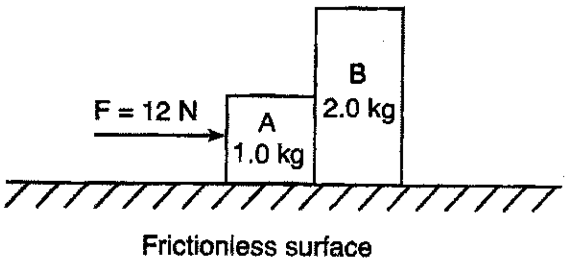
C)


1N

D)


0N

413. The diagram below shows a horizontal 12-newton force being applied to two blocks, *A* and *B*, initially at rest on a horizontal, frictionless surface. Block *A* has a mass of 1.0 kilogram and block *B* has a mass of 2.0 kilograms.



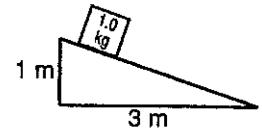
The magnitude of the acceleration of block *B* is (Skill 20)

A) 6.0 m/s^2
B) ~~2.0 m/s^2~~
C) 3.0 m/s^2
D) 4.0 m/s^2

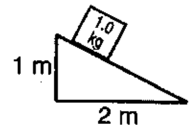
$F_{Net} = 12N$
$m = 3kg$
$a = \frac{F_{Net}}{m} = 4 m/s^2$

414. A 1.0-kilogram block is placed on each of four frictionless planes inclined at different angles. On which inclined plane will the acceleration of the block be greatest? (Skill 22)

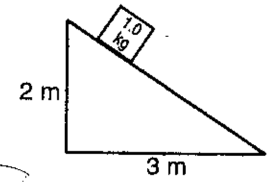
A)



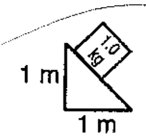
B)



C)



D)



$ma = mg\sin\theta$

$F_{net} = F_{g\parallel}$
$ma = mg\sin\theta$
$a = g\sin\theta$
greatest angle = greatest acceleration

415. As a meteor moves from a distance of 16 Earth radii to a distance of 2 Earth radii from the center of Earth, the magnitude of the gravitational force between the meteor and Earth becomes (Skill R,26)

A) $\frac{1}{8}$ as great
B) 8 times as great
C) 64 times as great
D) 4 times as great

16	2	
r=16	r=2	÷8
F_g		x64

$F_g = \frac{Gm_1m_2}{r^2}$

416. A 2.00-kilogram object weighs 19.6 newtons on Earth. If the acceleration due to gravity on Mars is 3.71 meters per second^2, what is the object's mass on Mars? (Skill 20)

m = 2 kg
F_g = 19.6 N

A) 2.64 kg
B) 2.00 kg
C) 19.6 N
D) 7.42 N

mass doesn't change

417. Base your answer to the following question on the information and table below.

The weight of an object was determined at five different distances from the center of Earth. The results are shown in the table below. Position *A* represents results for the object at the surface of Earth.

Position	Distance from Earth's Center (m)	Weight (N)
A	6.37×10^6 1r	1.0×10^3
B	1.27×10^7 2r	2.5×10^2 ÷4
C	1.91×10^7 3r	1.1×10^2 ÷9
D	2.55×10^7 4r	6.3×10^1 ÷16
E	3.19×10^7 5r	4.0×10^1 ÷25

F_g at A is 36 x greater than F_g of 28 N
$\frac{1000\text{ N}}{28\text{ N}} = 36$
If F ÷ 36, r x $\sqrt{36}$
r x 6

6r ... 28 ÷ 36

At what distance from the center of Earth is the weight of the object approximately 28 newtons? (Skill 26)

A) 3.5×10^7 m
B) 3.8×10^7 m
C) 4.1×10^7 m
D) 4.5×10^7 m

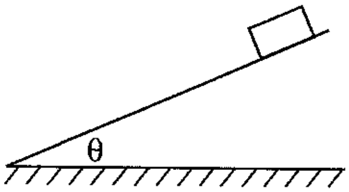
r_A $(6.37 \times 10^6)(6)$
(3.82×10^7)

418. An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor? (Skill 23)

A) 2.4 N
B) 3.4 N
C) 8.0 N
D) 27 N

equilibrium
$F_f = \mu F_N$
$F_f = (.3)(8\text{ N}) = 2.4\text{ N}$

419. The diagram below shows a block sliding down a plane inclined at angle θ with the horizontal.



As angle θ is increased, the coefficient of kinetic friction between the bottom surface of the block and the surface of the incline will (Skill 23&22)

A) decrease B) increase

C) remain the same

μ doesn't change

F_f & F_N do

420. What is the minimum horizontal force needed to start a 300. kilogram steel block on a steel table in motion? (Skill 23)

A) 5.70 N B) 7.40 N

C) 1710 N D) 2220 N ← they used 10 m/s²

$F_f = \mu F_N$

$(.74)(mg\cos\theta) = (.74)(300kg)(9.81 m/s^2) = 2177 N$

421. Jim wishes to push a 100. N wood crate across a wood floor. What is the minimum horizontal force that would be required to start the crate moving? (Skill 23)

A) 30. N B) 42 N

C) 72 N D) 100 N

$F_f = \mu F_N$

$= (.42)(100N)$

422. Two 20.-newton forces act concurrently on an object. What angle between these forces will produce a resultant force with the greatest magnitude? (Skill 22)

A) 0° ← same direction B) 45°

C) 90.° D) 180.°

423. Two concurrent forces have a maximum resultant of 45 Newtons and a minimum resultant of 5 Newtons. What is the magnitude of each of these forces? (Skill 22)

A) 0 N and 45 N B) 5 N and 9 N

C) 20. N and 25 N D) 0 N and 50. N

424. An airplane flies with a velocity of 750. kilometers per hour, 30.0° south of east. What is the magnitude of the eastward component of the plane's velocity? (Skill 8 & 10)

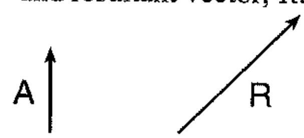
A) 866 km/h B) 650 km/h

C) 433 km/h D) 375km/h

$V_x = V\cos\theta$

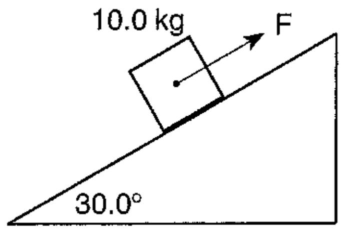
$V_x = (750 km/h)(\cos 30°)$

425. The diagram below represents a force vector, *A* and resultant vector, *R*.



Which force vector *B* below could be added to force vector *A* to produce resultant vector, *R*. (Skill 22)

426. The diagram below shows a 10.0-kilogram mass held at rest on a frictionless 30.0° incline by force F.

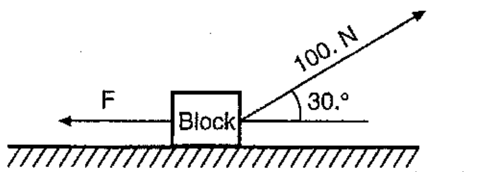


What is the approximate magnitude of force F? (Skill22)

A) 9.81 N B) 49.1 N
C) 85.0 N D) 98.1 N

$\Sigma F_{\parallel} = F + F_{g\parallel}$
$0 = F + mg\sin\theta$
$0 = F + (10kg)(9.81 m/s^2)\sin 30°$

427. The diagram below shows a block on a horizontal frictionless surface. A 100.- newton force acts on the block at an angle of 30.° above the horizontal.



(Skill22)

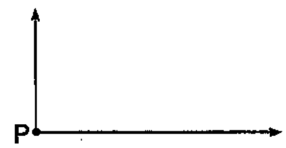
What is the magnitude of force F if it establishes equilibrium?

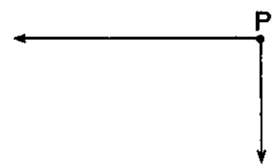
A) 50.0 N B) 86.6 N
C) 100. N D) 187 N

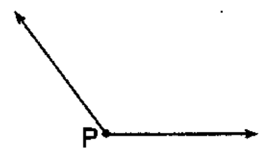
$\Sigma F_x = F + F_{Ax}$
$0 = F + F_A\cos\theta$
$0 = F + 50N$
$F = 50N$

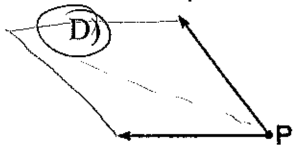
428. The vector below represents the resultant of two forces acting concurrently on an object at point P.

Which pair of vectors best represents two concurrent forces that combine to produce this resultant force vector? (Skill21)

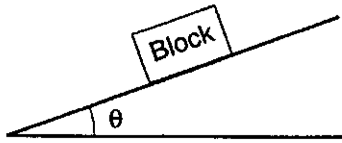
A)


B)


C)


D)


429. In the diagram below, a block rests on a ramp, making angle Θ with the horizontal.



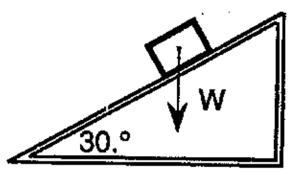
(Skill 22)

If angle Θ is increased, what will occur?

A) ~~The block's mass will decrease.~~
B) ~~The block's weight will increase.~~
C) The block's component of weight parallel to the ramp will decrease.
D) The block's component of weight parallel to the ramp will increase.

$F_{g\parallel} = mg\sin\theta$

430. In the diagram below, the weight of a box on a plane inclined at 30. is represented by the vector *W*.



What is the magnitude of the component of the weight (*W*) that acts parallel to the incline?

A) *W*
B) 0.50 *W* (skill 22)
C) 0.87 *W*
D) 1.5 *W*

$F_{g\parallel} = F_g\sin\theta$

431. During an emergency stop, a 1.5×10^3-kilogram car lost a total of 3.0×10^5 joules of kinetic energy. What was the speed of the car at the moment the brakes were applied? (Skill 28)

A) 10. m/s
B) 14 m.s
C) 20. m/s
D) 25 m/s

$KE = 3\times10^5$ J
$m = 1.5\times10^3$ kg
$v = ?$

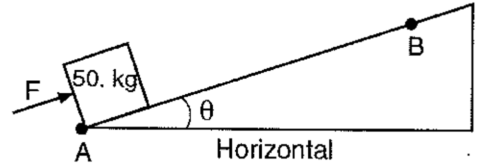
$KE = \frac{1}{2}mv^2$
$3\times10^5\text{ J} = \frac{1}{2}(1.5\times10^3\text{ kg})v^2$
$v = \sqrt{400}$

432. Which statement describes the kinetic energy and total mechanical energy of a block as it is pulled at constant speed up an incline? (Skill 13)

A) Kinetic energy decreases and total mechanical energy increases.
B) Kinetic energy decreases and total mechanical energy remains the same.
C) Kinetic energy remains the same and total mechanical energy increases.
D) Kinetic energy remains the same and total mechanical energy remains the same.

v doesn't change, h does

433. The diagram below shows a 50.-kilogram crate on a frictionless plane at angle *θ* to the horizontal. The crate is pushed at constant speed up the incline from point *A* to point *B* by force *F*.



If angle *θ* were increased, what would be the effect on the magnitude of force *F* and the total work *W* done on the crate as it is moved from *A* to *B*? (Skill 29, 30)

A) *W* would remain the same and the magnitude of *F* would decrease.
B) *W* would remain the same and the magnitude of *F* would increase.
C) *W* would increase and the magnitude of *F* would decrease.
D) *W* would increase and the magnitude of *F* would increase.

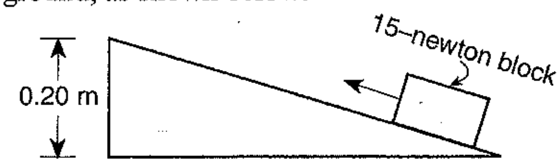
d_{AB} remains the same
$F_{g\parallel}$ increases

434. A horizontal force of 40 Newtons pushes a block along a level table at a constant speed of 2 meters per second. How much work is done on the block in 6 seconds? (Skill 29)

A) 80 J B) 120 J
C) 240 J **D) 480 J**

W = Fd = Fvt = (40N)(2m/s)(6s) = 480J

435. A block weighing 15 Newtons is pulled to the top of an incline that is 0.20 meter above the ground, as shown below.



If 4.0 joules of work are needed to pull the block the full length of the incline, how much work is done against friction? (Skill 29, 32)

A) 1.0 J B) 0.0 J C) 3.0 J D) 7.0 J

W = 4J
PE gained = mgh = (15N)(.2N) = 3J
Q = $E_T - (PE_f + KE_f)$ = 1J

436. The rate at which work is done is measured in (Skill 30)

A) Newtons B) joules
C) calories **D) watts**

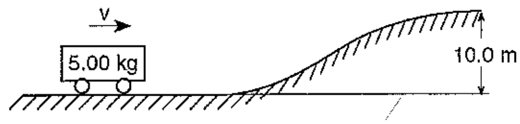
437. A 95-kilogram student climbs 4.0 meters up a rope in 3.0 seconds. What is the power output of the student? (Skill 30)

A) 1.3×10^2 W B) 3.8×10^2 W
C) 1.2×10^3 W D) 3.7×10^3 W

m = 95kg
h = 4m
t = 3s
P = ?

P = mgh / t = (95kg)(9.81 m/s²)(4m) / 3s

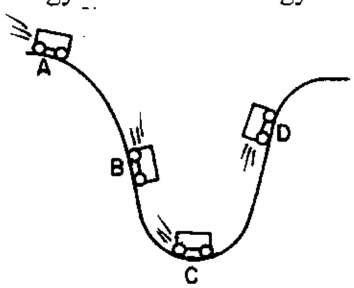
438. The diagram below shows a moving, 5.00-kilogram cart at the foot of a hill 10.0 meters high. For the cart to reach the top of the hill, what is the minimum kinetic energy of the cart in the position shown? [Neglect energy loss due to friction.] (Skill 31)



A) 4.91 J B) 50.0 J
C) 250. J **D) 491 J**

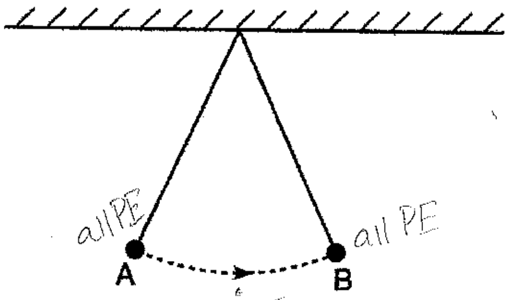
PE top = KE bottom
mgh = KE
(5kg)(9.81)(10m) = 490.5

439. The diagram below shows a cart at four positions as it moves along a frictionless track. At which positions is the sum of the potential energy and kinetic energy of the cart the same? (Skill 31)



A) *A* and *B*, only
B) *B* and *C*, only
C) *C* and *D*, only
D) all positions, *A* through *D*

440. In the diagram below, an ideal pendulum released from position *A* swings freely to position *B*.



As the pendulum swings from *A* to *B*, its total mechanical energy (Skill31)

A) decreases , then increases
B) increases, only
C) increases, then decreases
D) remains the same

441. A 55.0-kilogram diver falls freely from a diving platform that is 3.00 meters above the surface of the water in a pool. When she is 1.00 meter above the water, what are her gravitational potential energy and kinetic energy with respect to the water's surface? (Skill31)

A) *PE* = 1620 J and *KE* = 0 J
B) *PE* = 1080 J and *KE* = 540 J
C) *PE* = 810 J and *KE* = 810 J
D) *PE* = 540 J and *KE* = 1080 J

442. As an object falls freely, the kinetic energy of the object (Skill31)

A) decreases
B) increases
C) remains the same

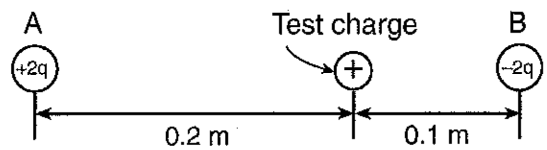
443. As a block slides across a table, its speed decreases while its temperature increases. Which two changes occur in the block's energy as it slides? (Skill32)

A) a decrease in kinetic energy and an increase in internal energy
B) an increase in kinetic energy and a decrease in internal energy
C) a decrease in both kinetic energy and internal energy
D) an increase in both kinetic energy and internal energy

444. A metal sphere having an excess of +5 elementary charges has a net electric charge of (Skill34)

A) 1.6×10^{-19} C
B) 8.0×10^{-19} C
C) 5.0×10^{0} C
D) 3.2×10^{19} C

445. In the diagram below, a positive test charge is located between two charged spheres, A and B. Sphere A has a charge of $+2q$ and is located 0.2 meter from the test charge. Sphere B has a charge of $-2q$ and is located 0.1 meter from the test charge.

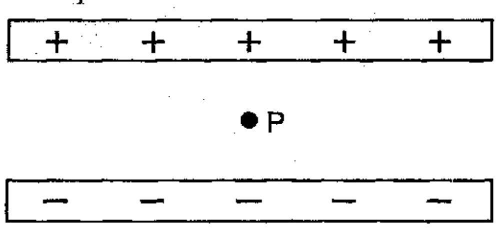


If the magnitude of the force on the test charge due to sphere A is F, what is the magnitude of the force on the test charge due to sphere B? (Skill 35)

A) $\frac{F}{4}$ B) 2F C) $\frac{F}{2}$ D) 4F

	A	B
q	+2	−2q
r	.2m	.1m ÷2
F	F	×4

446. The diagram below shows a point, P, located midway between two oppositely charged parallel plates.

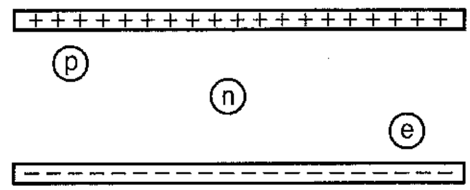


If an electron is introduced at point P, the electron will (Skill 36)

A) travel at constant speed toward the positively charged plate
B) travel at constant speed toward the negatively charged plate
C) accelerate toward the positively charged plate
D) accelerate toward the negatively charged plate

Experiences a uniform force & therefore accelerates

447. In the diagram below, proton p, neutron n, and electron e are located as shown between two oppositely charged plates.



The magnitude of acceleration will be greatest for the (Skill 36)

A) neutron, because it has the greatest mass
B) neutron, because it is neutral
C) electron, because it has the smallest mass
D) proton, because it is farthest from the negative plate

n experiences 0 force due to lack of charge
p & e experience equal force but e accelerates more due to low m
$F_{net} = F_e = ma$

448. What is the current in a wire if 3.4×10^{19} electrons pass by a point in this wire every 60. seconds? (Skill 38)

A) 1.8×10^{-18} A B) 3.1×10^{-11} A
C) 9.1×10^{-2} A D) 11 A

$3.4 \times 10^{19} e \times \frac{1.6 \times 10^{-19} C}{1e} = \frac{5.44 C}{60} = .091 C/s$

Amp equals C/s so e converts to C 9.1×10^{-2} A

449. The current through a lightbulb is 2.0 amperes. How many coulombs of electric charge pass through the lightbulb in one minute? (Skill 38)

A) 60. C B) 2.0 C
C) 120 C D) 240 C

$I = 2 C/s$
$t = 60 s$
$I = q/t$

$q = It = (2 C/s)(60 s) = 120 C$

450. A manufacturer recommends that the longer the extension cord used with an electric drill, the thicker (heavier gauge) the extension cord should be. This recommendation is made because the resistance of a wire varies (Skill 39)

A) directly with length and inversely with cross-sectional area
B) inversely with length and directly with cross-sectional area
C) directly with both length and cross-sectional area
D) inversely with both length and cross-sectional area

$R = \frac{\rho L}{A}$

451. Which change decreases the resistance of a piece of copper wire? (Skill 39)

A) increasing the wire's length ↑
B) increasing the wire's resistivity ↑
C) decreasing the wire's temperature ↓
D) decreasing the wire's diameter ↑

Not in equation – basic fact

452. An incandescent light bulb is supplied with a constant potential difference of 120 volts. As the filament of the bulb heats up, its resistance (Skill 39)

A) increases and the current through it decreases
B) increases and the current through it increases
C) decreases and the current through it decreases
D) decreases and the current through it increases

$V = 120V$

heat increases R so ↓ I

$I = V/R$

453. If the diameter of a wire were halved, its electrical resistance would (Skill 39)

A) quarter
B) quadruple
C) double
D) halve

$R = \frac{\rho L}{\pi r^2}$ thin wire ↑ R

inverse square

454. A 400.-ohm resistor is connected to a 9.00-volt battery. The current through the resistor is (Skill 40)

A) 0.225 mA
B) 22.5 mA
C) 44.4 mA
D) 3600 mA

$I = V/R = \frac{9V}{400\Omega} = .0225A$

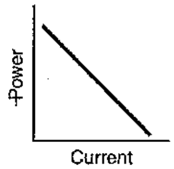
$= 22.5 mA$

455. Which graph best represents the relationship between the electrical power and the current in a resistor that obeys Ohms Law? (Skill 40)

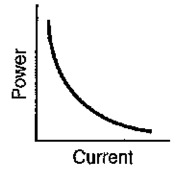
P, I, R (obeys Ohm's Law)

$P = I^2R$

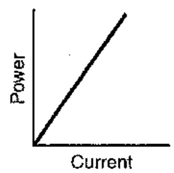
A)



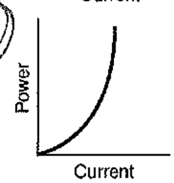
B)



C)



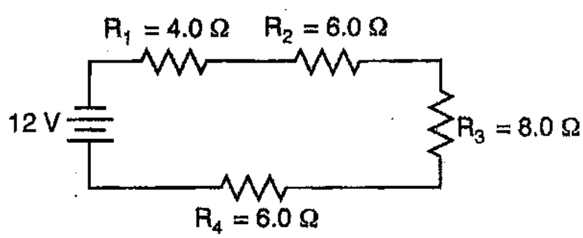
D)



456. As more resistors are added in series across a battery, the potential drop across each resistor (Skill 43)

A) decreases
B) increases
C) remains the same

457. The circuit diagram below represents four resistors connected to a 12-volt source.



What is the total current in the circuit? (Skill 43)

A) 0.50 A
B) 2.0 A
C) 8.6 A
D) 24 A

V	I	R
2V	.5	4Ω
3V	.5	6Ω
4V	.5	8Ω
3V	.5	6Ω
12V	.5A	24Ω

458. A 3-ohm resistor and a 6-ohm resistor are connected in parallel across a 9-volt battery. Which statement best compares the potential difference across each resistor? (Skill 44)

A) The potential difference across the 6-ohm resistor is the same as the potential difference across the 3-ohm resistor.
B) The potential difference across the 6-ohm resistor is twice as great as the potential difference across the 3-ohm resistor.
C) The potential difference across the 6-ohm resistor is half as great as the potential difference across the 3-ohm resistor.
D) The potential difference across the 6-ohm resistor is four times as great as the potential difference across the 3-ohm resistor.

$V_T = V_1 = V_2 = V_3$

459. As the number of resistors connected in parallel to a constant voltage source is increased, the potential difference across each resistor (Skill 44)

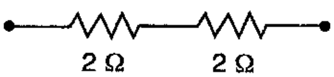
A) decreases

B) increases

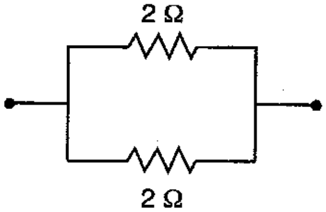
C) remains the same

460. Which combination of resistors has the *smallest* equivalent resistance? (Skill 43 & 44)

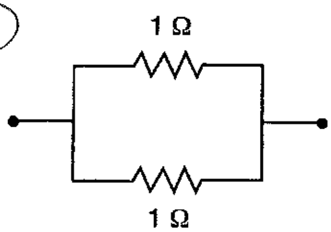
A)



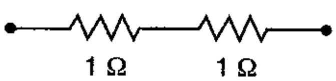
B)



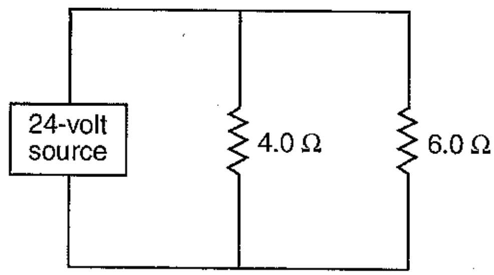
C)



D)



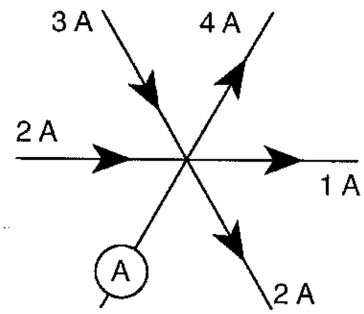
461. Base your answer to the following question on the circuit diagram below, which shows two resistors connected to a 24-volt source of potential difference.



What is the total resistance of the circuit?

A) 0.42 B) 2.4 C) 5.0 D) 10 (Skill 44)

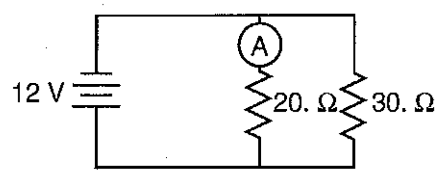
462. The diagram below represents currents in a segment of an electric circuit.



What is the reading of ammeter *A*? (Skill 45)

A) 1 A B) 2 A C) 3 A D) 4 A

463. Base your answer to the following question on the information and diagram below. A 20.-ohm resistor and a 30.-ohm resistor are connected in parallel to a 12-volt battery as shown. An ammeter is connected as shown.



$I = V/R = \frac{12V}{20\Omega} = .6A$

What is the current reading of the ammeter? (Skill 44)

A) 1.0 A
B) 0.60 A
C) 0.40 A
D) 0.20 A

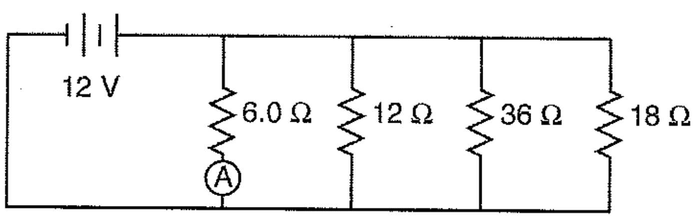
464. As the number of resistors in a parallel circuit is increased, what happens to the equivalent resistance of the circuit and total current in the circuit? (Skill 44)

A) Both equivalent resistance and total current decrease.
B) Both equivalent resistance and total current increase.
C) Equivalent resistance decreases and total current increases.
D) Equivalent resistance increases and total current decreases.

adding more resistors in parallel decreases the R_{eq}

I is inverse to R so if R↓ I↑

465. Base your answer to the following question on the diagram below, which represents an electric circuit consisting of four resistors and a 12-volt battery.



V	I	R	P
12	2A	6	24W
12	1A	12	12W
12	.33	36	4W
12	.67	18	8W
Total 12	4A	3Ω	48W

How much power is dissipated in the 36-ohm resistor? (Skill 41,44)

A) 110 W B) 48 W C) 3.0 W D) 4.0 W

466. A light bulb operating at 120 volts draws a current of 0.50 ampere for 240 seconds. The power rating of the light bulb is (Skill 41)

A) 30. W B) 60. W
C) 75 W D) 120 W

$P = IV = (.5A)(120V) = 60W$

467. A potential drop of 50. volts is measured across a 250-ohm resistor. What is the power developed in the resistor? (Skill 41)

A) 0.20 W B) 5.0 W
C) 10. W D) 50. W

$P = V^2/R = \frac{(50V)^2}{250\Omega} = 10W$

468. Which object will have the greatest change in electrical energy? (Skill 41)

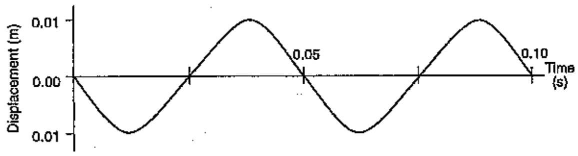
A) an electron moved through a potential difference of 2.0 V (1.6×10^{-19} C)
B) a metal sphere with a charge of 1.0×10^{-9} C moved through a potential difference of 2.0 V
C) an electron moved through a potential difference of 4.0 V (1.6×10^{-19} C)
D) a metal sphere with a charge of 1.0×10^{-9} C moved through a potential difference of 4.0 V

469. An elementary charge is accelerated by a potential difference of 9.0 volts. The total energy acquired by the charge is

A) 9.0 eV B) 12 eV
C) 3.0 eV D) 27 eV

$W = qV = (1e)(9V) = 9eV$

470. The graph below shows displacement versus time for a particle of a uniform medium as a wave passes through the medium.



What is the frequency of the wave? (Skill 48)

A) 10 Hz
B) 20 Hz
C) 50 Hz
D) 100 Hz

2 cycles = .1 s

f = cycles / second = 2 cycles / .1 s

471. A sound wave traveling eastward through air causes the air molecules to (Skill 50)

A) vibrate east and west
B) vibrate north and south
C) move eastward, only
D) move northward, only

Sound is a longitudinal wave
⟷ east/west
particle
energy east

472. A distance of 1.0×10^{-2} meter separates successive crests of a periodic wave produced in a shallow tank of water. If a crest passes a point in the tank every 4.0×10^{-1} second, what is the speed of this wave? (Skill 48)

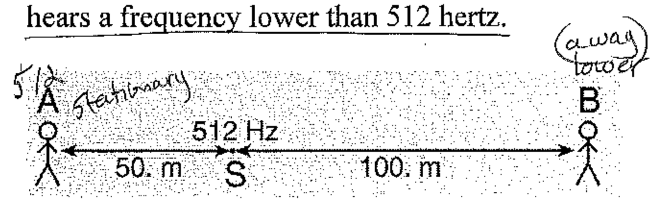
A) 2.5×10^{-4} m/s
B) 4.0×10^{-3} m/s
C) 2.5×10^{-2} m/s
D) 4.0×10^{-1} m/s

$\lambda = 1 \times 10^{-2}$ m

$T = 4 \times 10^{-1}$ s

$v = \frac{\lambda}{T}$ or λf

473. In the diagram below, a stationary source located at point *S* produces sound having a constant frequency of 512 hertz. Observer *A*, 50. meters to the left of *S*, hears a frequency of 512 hertz. Observer *B*, 100. meters to the right of *S*, hears a frequency lower than 512 hertz.



Which statement best describes the motion of the observers? (Skill 54)

A) Observer *A* is moving toward point *S*, and observer *B* is stationary.
B) Observer *A* is moving away from point *S*, and observer *B* is stationary.
C) Observer *A* is stationary, and observer *B* is moving toward point *S*.
D) Observer *A* is stationary, and observer *B* is moving away from point *S*.

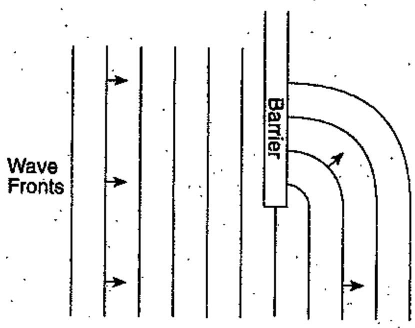
474. A source of waves and an observer are moving relative to each other. The observer will detect a steadily increasing frequency if (Skill 54)

A) he moves toward the source at a constant speed
B) the source moves away from him at a constant speed
C) he accelerates toward the source
D) the source accelerates away from him

Increasing f means coming toward you speeding up

higher constant f means coming toward constant speed

475. The diagram below shows a wave phenomenon.



The pattern of waves shown behind the barrier is the result of (Skill 52)

A) reflection B) refraction
C) diffraction D) interference

476. The time required for light to travel a distance of 1.5×10^{11} meters is closest to (Skill 51, 48)

A) 5.0×10^{2} s B) 2.0×10^{-3} s
C) 5.0×10^{-1} s D) 4.5×10^{19} s

$d = 1.5\times10^{11}$ m $t = d/v = \frac{1.5\times10^{11} \text{ m}}{3\times10^8 \text{ m/s}}$
$v = 3\times10^8$ m/s
$= .5\times10^3$ s
$= 5\times10^2$ s

477. Which phenomenon provides evidence that light has a wave nature? (Skill 57)

A) emission of light from an energy-level transition in a hydrogen atom photoelectric
B) diffraction of light passing through a narrow opening
C) absorption of light by a black sheet of paper photoelectric
D) reflection of light from a mirror Both wave & particle

478. Which phenomenon is best explained by the wave theory? (Skill 52, 57)

A) reflection
B) illumination
C) interference
D) the photoelectric effect

479. Which phenomenon can *not* be exhibited by longitudinal waves? (Skill 52)

A) reflection B) refraction
C) diffraction D) polarization

480. A change in the speed of a wave as it enters a new medium produces a change in (Skill 52, 56)

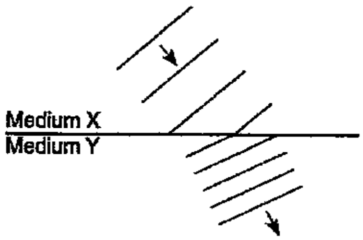
A) ~~frequency~~ B) period
C) wavelength D) phase

481. What happens to the frequency and the speed of an electromagnetic wave as it passes from air into glass? (Skill 52 to 56)

A) ~~The frequency decreases~~ and the speed increases.
B) ~~The frequency increases~~ and the speed decreases.
C) The frequency remains the same and the speed increases.
D) The frequency remains the same and the speed decreases.

n↑ v↓

482. The diagram below represents wave fronts traveling from medium X into medium Y.



All points on any one wave front shown must be (Skill 52-56)

A) traveling with the same speed
B) traveling in the same medium
C) in phase
D) superposed

483. What is the speed of light ($f = 5.09 \times 10^{14}$ Hz) in ethyl alcohol? (Skill 51)

A) ~~4.53×10^{-9} m/s~~ B) ~~2.43×10^{2} m/s~~
C) 1.24×10^{8} m/s D) 2.21×10^{8} m/s

$v = \frac{c}{n} = \frac{3\times10^8 \text{ m/s}}{1.36}$

484. As yellow light ($f = 5.09 \times 10$ 14 Hz) travels from zircon into diamond, the speed of the light (Skill 51)

A) decreases
B) increases
C) remains the same

485. What is the speed of light in a medium having an absolute index of refraction of 2.3? (Skill 51)

A) 0.77×10^{8} m/s B) 1.3×10^{8} m/s
C) 1.5×10^{8} m/s D) 2.3×10^{8} m/s

$v = \frac{c}{n} = \frac{3\times10^8 \text{ m/s}}{2.3}$

486. Moving electrons are found to exhibit properties of (Skill 57)

A) particles, only
B) waves, only
C) both particles and waves
D) neither particles nor waves

487. Light demonstrates the characteristics of (Skill 57)

A) particles, only
B) waves, only
C) both particles and waves
D) neither particles nor waves

488. What is the energy equivalent of a mass of 0.026 kilogram? (Skill 58)

A) 2.34×10^{15} J B) 2.3×10^{15} J
C) 2.34×10^{17} J D) 2.3×10^{17} J

$E = mc^2$
$= (.026 \text{ kg})(3\times10^8 \text{ m/s})^2$

489. A photon is emitted as the electron in a hydrogen atom drops from the $n = 5$ energy level directly to the $n = 3$ energy level. What is the energy of the emitted photon? (Skill 57)

A) 0.85 eV B) 0.97 eV
C) 1.51 eV D) 2.05 eV

490. Which type of photon is emitted when an electron in a hydrogen atom drops from the $n = 3$ to the $n = 2$ energy level? (Skill 57)

A) ultraviolet B) ~~infrared~~
C) radio wave D) visible light

491. The bright-line emission spectrum of an element can best be explained by (Skill 57)

A) electrons transitioning between discrete energy levels in the atoms of that element
B) ~~protons acting as both particles and waves~~
C) ~~electrons being located in the nucleus~~
D) ~~protons being dispersed uniformly throughout the atoms of that element~~

492. A top quark has an approximate charge of (Skill 47)

A) -1.07×10^{-19} C B) -2.40×10^{-19} C
C) $+1.07 \times 10^{-19}$ C D) $+2.40 \times 10^{-19}$ C

493. The composition of a meson with a charge of -1 elementary charge could be (Skill 47)

A) $s\bar{c}$ $-\frac{1}{3} + -\frac{2}{3}$ B) ~~dss~~
C) $u\bar{b}$ D) ~~$uc\bar{d}$~~

494. Compared to the mass and charge of a proton, an antiproton has (Skill 47, 58)

A) the same mass and the same charge
B) ~~greater mass and the same charge~~
C) the same mass and the opposite charge
D) greater mass and the opposite charge

495. The concept that electrons exhibit wave properties can best be demonstrated by the (Skill 57)

A) ~~emission of photoelectrons~~
B) scattering of alpha particles by electrons
C) collisions between photons and electrons
D) production of electron interference patterns

496. What is the minimum total energy released when an electron and its antiparticle (positron) annihilate each other? (Skill 58)

A) 1.64×10^{-13} J B) 8.20×10^{-14} J
C) 5.47×10^{-22} J D) 2.73×10^{-22} J

$E = mc^2$
$= 2(9.11\times10^{-31}\,kg)(3\times10^{8}\,m/s)^2 = 1.6\times10^{-13}\,J$

497. A golf ball is hit at an angle of 40.0° above the horizontal. The horizontal component of the golf ball's initial velocity is 16.0 meters per second. What is the magnitude of the ball's initial velocity? (Skill 18)

A) ~~12.3 m/s~~ B) 24.9 m/s
C) 20.9 m/s D) ~~10.3 m/s~~

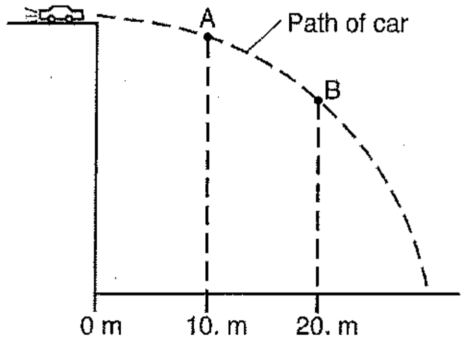
40°
16 m/s

$V_x = V\cos\theta$
$16\,m/s = V\cos 40°$

$V_x = 16\,m/s$
$V = ?$
$\theta = 40°$

498. **Note that the question below only has three choices.**

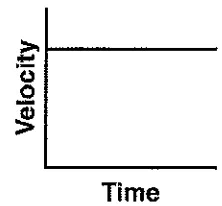
The diagram below represents the path of a stunt car that is driven off a cliff, neglecting friction.

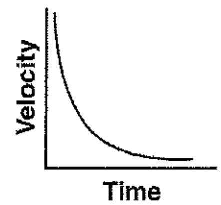


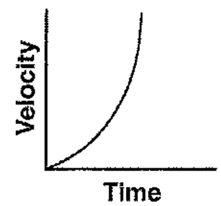
Compared to the horizontal component of the car's velocity at point A, the horizontal component of the car's velocity at point B is (Skill 16)

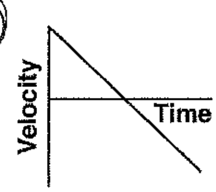
A) smaller
B) greater
C) the same

499. Which graph best represents the relationship between the velocity of an object thrown straight upward from Earth's surface and the time that elapses while it is in the air? [Neglect friction.] (Skill 15)

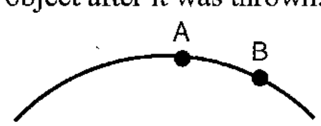
A)


B)


C)


D)


500. The diagram below represents the path of an object after it was thrown.



What happens to the object's acceleration as it travels from *A* to *B*? [Neglect friction.] (Skill 17)

A) It decreases.
B) It increases.
C) It remains the same. 9.8 m/s² downward

501. A projectile is launched at an angle above the ground. The horizontal component of the projectile's velocity. v_x, is initially 40. meters per second. The vertical component of the projectile's velocity, v_y, is initially 30. meters per second. What are the components of the projectile's velocity after 2.0 seconds of flight? [Neglect friction.] (Skill 17)

A) v_x = 40. m/s and v_y = 10. m/s
B) v_x = 40. m/s and v_y = 30. m/s
C) v_x = 20. m/s and v_y = 10. m/s
D) v_x = 20. m/s and v_y = 30. m/s

$V_x = 40$ m/s remains the same
$V_y = 30$ m/s
$V_{fy} = v_{iy} + at$
$V_{fy} = 30\text{ m/s} + (-10\text{ m/s}^2)(2\text{ s})$
$V_{fy} = 10$ m/s

502. A soccer ball kicked on a level field has an initial vertical velocity component of 15.0 meters per second. Assuming the ball lands at the same height from which it was kicked, what is the total time the ball is in the air? [Neglect friction.] (Skill 17)

A) 0.654 s
B) 1.53 s
C) 3.06 s
D) 6.12

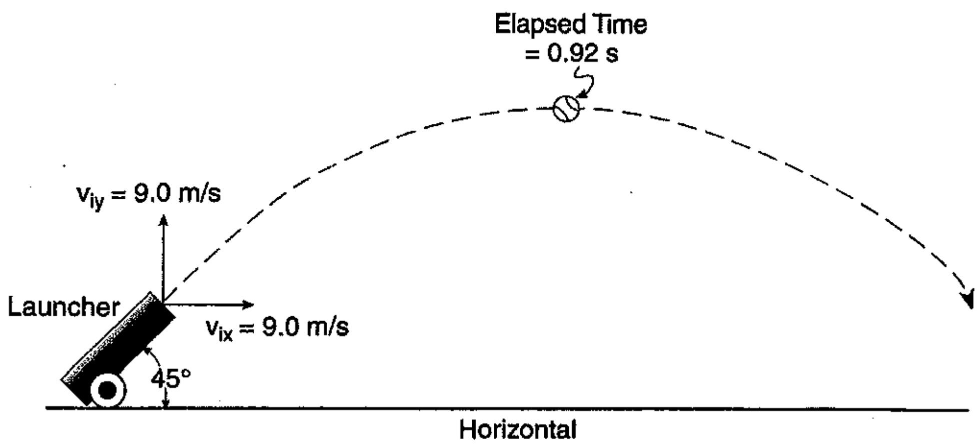
$V_{iy} = 15$ m/s
$V_{fy} = -15$ m/s
$a = -9.81\text{ m/s}^2$
$t = ?$

503. A ball thrown vertically upward reaches a maximum height of 30. meters above the surface of Earth. At its maximum height, the speed of the ball is (Skill 15)

A) 0.0 m/s
B) 9.8 m/s
C) 3.1 m/s
D) 24 m/s

504. Base your answer to the following question on the diagram and information below.

A machine launches a tennis ball at an angle of 45° with the horizontal, as shown. The ball has an initial vertical velocity of 9.0 meters per second and an initial horizontal velocity of 9.0 meters per second. The ball reaches its maximum height 0.92 second after its launch. [Neglect air resistance and assume the ball lands at the same height above the ground from which it was launched.]



The speed at which the launcher fires tennis balls is constant, but the angle between the launcher and the horizontal can be varied. As the angle is decreased from 45° to 30.°, the range of the tennis balls (Skill 17)

A) decreases B) increases
C) remains the same

505. Four cannonballs, each with mass M and initial velocity V, are fired from a cannon at different angles relative to the Earth. Neglecting air friction, which angular direction of the cannon produces the greatest projectile height? (Skill 17)

A) 90° B) 70° C) 45° D) 20°

506. Base your answer to the following question on the information below.

A ball is projected vertically upward from the surface of the Earth with an initial speed of +49 meters per second. The ball reaches its maximum height in 5.0 seconds. (Disregard air resistance.)

What is the maximum height reached by the ball? (Skill 15)

A) 24.5 m
B) 49.0 m
C) 122.5 m
D) 245 m

$V_i = 0$ high pt
$V_f = 49$ m/s landing
$a = 9.81$ m/s²
$d = \frac{1}{2}at^2$

507. An object travels in a circular orbit. If the speed of the object is doubled, its centripetal acceleration will be (Skill 25)

A) halved
B) doubled
C) quartered
D) quadrupled

$a_c = \frac{v^2}{r}$

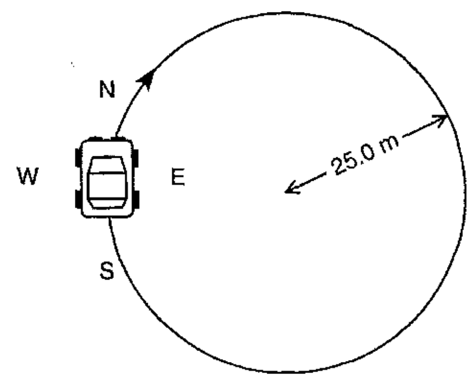
508. The magnitude of the centripetal force acting on an object traveling in a horizontal, circular path will *decrease* if the (Skill 25)

A) radius of the path is increased ↓
B) mass of the object is increased ↑
C) direction of motion of the object is reversed —
D) speed of the object is increased ↑

$F_c = \frac{mv^2}{r}$

509. Base your answer to the following question on the information and diagram below.

A 1.00×10^3 -kilogram car is driven clockwise around a flat circular track of radius 25.0 meters. The speed of the car is a constant 5.00 meters per second.



What minimum friction force must exist between the tires and the road to prevent the car from skidding as it rounds the curve? (Skill 25)

A) 1.25×10^5 N
B) 9.80×10^4 N
C) 5.00×10^3 N
D) 1.00×10^3 N

$F_c = F_f = \frac{mv^2}{r} = \frac{(1000\text{kg})(5\text{m/s})^2}{25}$