

Multiple Choice Section

Q5

A rock suspended by a weighing scale weighs 25 N out of water, and 10 N when submerged in water.

What is the buoyant force on the rock?

- A. 15 N
 - B. 10 N
 - C. 40 N
 - D. none of these
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Q6

Light bends in a gravitational field. Why isn't this bending taken into consideration by surveyors who use laser beams as straight lines?

- A. The bending of light occurs only in outer space.
 - B. Light travels so fast that the curvature is not noticeable for surveying purposes.
 - C. Laser light is an exception to this rule.
 - D. Red light doesn't bend so much, which is why lasers are red.
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Q7

Scientific evidence supports the date of the Big Bang event at

- A. 7000 years ago
 - B. 5 billion years ago
 - C. 100,000 years ago
 - D. about 14 billion years ago
-

Q8

The star Polaris is always directly over

- A. the equator
- B. any location north of the equator

- C. the North Pole
 - D. the South Pole
-

Q9

If you toss a ball straight upward at 30 m/s with no air resistance, 6 seconds later its speed is

- A. 0 m/s
 - B. 30 m/s
 - C. 20 m/s
 - D. 10 m/s
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Q10

A 50 N object falling in air experiences 30 N of air resistance.

The amount of net force on the falling object is

- A. 20 N
 - B. 50 N
 - C. 80 N
 - D. 0 N
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Q11

A girl pushes with a 120 N horizontal force on a 20 kg crate of coffee resting on a warehouse floor.

The force of friction on the crate is 60 N.

What is the acceleration of the crate?

- A. 0 m/s^2
 - B. 9 m/s^2
 - C. 6 m/s^2
 - D. 3 m/s^2
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Q12

A 10 kg bag of groceries is tossed onto a table at a speed of 5 m/s and slides to a stop in 2 s. The direction of the friction force acting on the bag is

- A. The same as the direction of motion
 - B. Opposite to the direction of motion
 - C. Downward
 - D. Upward
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Q13

If your mass remained the same while the mass of Earth doubled while staying the same size, your weight would

- A. be the same
 - B. double
 - C. decrease to one-half
 - D. quadruple
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Q14

What is the amount of heat Q needed to warm 100 kg of water from 20°C to 37°C ?

Given: $c = 4.18 \text{ kJ}/(\text{kg}\cdot^{\circ}\text{C})$

- A. 3550 kJ
 - B. 7730 kJ
 - C. 7100 kJ
 - D. 17000 kJ
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Q15

You heat a half-cup of tea and its temperature rises by 16°C .

How much will the temperature rise if you add the same amount of heat to a full cup of tea?

- A. 16°C
 - B. 8°C
 - C. 4°C
 - D. 2°C
-

Q16

The quantity of heat needed to raise the temperature of a certain substance a specific amount is 1 Calorie (with capital C).

This is the same amount of energy as

- A. 1000 calories
 - B. 4180 calories
 - C. Neither of these
 - D. Both of these
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Q17

A bimetallic strip used in thermostats relies on the fact that different metals have different

- A. rates of thermal expansion
 - B. thermal energies at different temperatures
 - C. specific heat capacities
 - D. all of these
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Q18

A power line with a resistance of $4\ \Omega$ draws a current of 40 A.

The power dissipated in the line is

- A. 320 W
 - B. 160 W
 - C. 640 W
 - D. 6400 W
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Q19

The nucleus of an atom is charged

- A. positively
 - B. negatively
 - C. both
 - D. none of the above
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Q20

Two charges separated by 1 m exert a 10 N force on each other.

If the charges are pushed to 0.25 m separation, the force on each charge will be

- A. 2 N
 - B. 16 N
 - C. 5 N
 - D. 4 N
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Q21

If a potential difference of 24.0 V is required to produce a current of 3.0 A in a wire, the resistance of the wire is

- A. $8.0\ \Omega$
 - B. $27\ \Omega$
 - C. $0.50\ \Omega$
 - D. $6.0\ \Omega$
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Writing Section

Problem 1

A rock is thrown horizontally from a bridge and hits the water below.

The rock travels a smooth parabolic path and is airborne for $t = 2\text{ s}$.

What is the height of the bridge if the time the rock is airborne is 2 s?

Problem 2

a) How much thermal energy is needed to heat 650 g of copper from 25°C to 75°C ?

Given: specific heat of copper = $390\text{ J}/(\text{kg}\cdot^\circ\text{C})$

b) A block of ice at 0°C is dropped and completely melts upon impact.

Assume no air resistance and that all energy goes into melting the ice.

Show that the height required is at least 34 km.

Given: latent heat of fusion of water = $335,000\text{ J/kg}$

Problem 3

a) How many kilometers is a light-year?

Given: speed of light $c = 300 \times 10^3 \text{ km/s}$

b) In the film *Avatar*, humans travel from Earth to Pandora, about 4.3 light-years away.

If the spacecraft travels at 1200 km/h, how long will the journey take?

Express your answer in years.

c) If the spacecraft can travel at $0.2c$ (20% of the speed of light), how long will the journey take?

Express your answer in years.