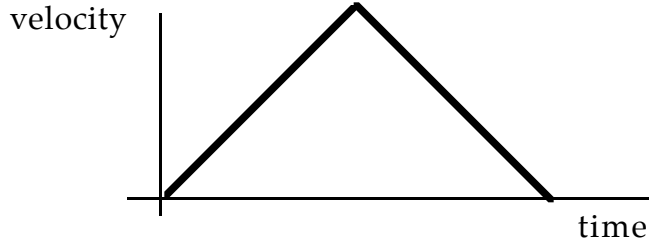
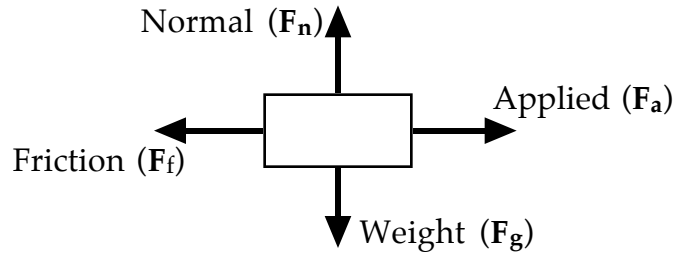


1. Which of the following motions is best described by the velocity-time graph below?



- A) A marble rolling up a hill and down the other side.
 B) A car speeding up on a road, and braking to a stop.
 C) A Loonie coin is thrown up and falls down.
 D) A horse runs one lap around a circular track.
 E) A basketball is dropped and bounces back up.
2. Jill rode up a hill at a constant speed of 10.0 km/h, then returned down the same hill at a constant speed of 20.0 km/h. If the time to turn around is ignored, what was her average speed for the whole trip?
 A) 0 B) 13.3 km/h C) 15.0 km/h D) 16.7 km/h
 E) not enough information to answer the question
3. In the Drop Zone amusement park ride, Sam falls vertically from rest. Assuming constant acceleration, he falls a distance d_1 during the first second and an additional distance d_2 in the next second. The ratio of $d_2:d_1$ is
 A) 1:1 B) 2:1 C) 3:1 D) 4:1 E) 5:1
4. A stone of mass M thrown straight up with initial velocity V_1 reaches a height H . A second stone of mass $2M$, thrown straight up with an initial velocity $2V_1$, will reach a height
 A) $H/2$ B) H C) $\sqrt{2}H$ D) $2H$ E) $4H$
5. Cindy notes that if she leaves now and travels the straight road to her house at 30 km/h, she will arrive at 10 AM. If she travels at 20 km/h, she will arrive at 12 noon. How fast does she have to travel in order to arrive at 11 AM?
 A) 22.5 km/h B) 24 km/h C) 25 km/h
 D) 27.5 km/h E) not enough information is given
6. Suppose that a hole were drilled to the centre of a uniform solid spherical planet. A stone is dropped into the hole. When the stone is at the planet's centre, compared with its values at the surface, you might expect that the stone's
 A) mass and weight are both unchanged.
 B) mass and weight are both zero.
 C) mass is unchanged and its weight is zero.
 D) mass is zero and its weight is unchanged.
 E) weight cannot be determined anywhere with this information.
7. A 2.0 kg block of wood is dragged across a rough level floor at a constant velocity of 3.0 m/s by a horizontally applied force of 10 N. Compare the magnitudes of F_a to F_f , and F_N to F_g .



(Note: Not necessarily to scale. Arrows are intended to show only the direction of the forces.)

- A) $F_a > F_f$ and $F_N = F_g$
 B) $F_a < F_f$ and $F_N = F_g$
 C) $F_a = F_f$ and $F_N = F_g$
 D) $F_a > F_f$ and $F_N > F_g$
 E) $F_a < F_f$ and $F_N < F_g$

8. The resistance of a hot dog, 15 cm long and 2.0 cm in diameter, is measured to be 9.0Ω . What would be the resistance of a jumbo hot dog that is 30 cm long and 3.0 cm in diameter?

(Assume a constant hot dog resistivity)

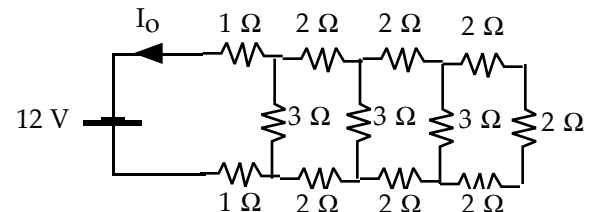
- A) 18Ω B) 8.0Ω C) 6.0Ω
 D) 2.7Ω E) 1.8Ω

9. An electric heater uses two resistors as heating elements. While experimenting, Evelyn finds that if only resistor 1 is connected, the time taken to boil the water in the filled heater is 5 minutes. With only resistor 2 connected, the time taken to boil the same amount of water is 2 minutes.

When the two resistors are wired in series, how much time should it take to boil the same amount of water? (Assume a constant voltage source)

- A) 7/10 min B) 10/7 min C) 3.0 min
 D) 3.5 min E) 7.0 min

10. In the circuit below, current I_0 is



- A) 0.48 A B) 2.4 A C) 3.0 A
 D) 4.0 A E) 6.0 A

11. When rubbed with silk, copper becomes negatively charged, while lead becomes positively charged. When rubbed with wool, acetate becomes positive, and lead becomes negative. What is the correct order of these materials in the electrostatic series, from loosely held electrons to tightly held?

A) copper, lead, acetate
 B) copper, acetate, lead
 C) lead, copper, acetate
 D) acetate, lead, copper
 E) acetate, copper, lead

12. Which of the following elements is not strongly ferromagnetic?

A) iron
 B) tin
 C) nickel
 D) cobalt
 E) gadolinium

13. The magnitude of the force on a conductor of length l , carrying current I , in a magnetic field B perpendicular to the conductor, is given by the expression $F = IlB$. The unit of magnetic field strength is the Tesla. Which of the following is equal to a Tesla?

A) $\text{kg}/(\text{C}\cdot\text{s})$ B) $\text{kg}\cdot\text{s}/(\text{C}\cdot\text{m})$ C) $\text{kg}\cdot\text{C}\cdot\text{m}^2/\text{s}^3$
 D) $\text{kg}\cdot\text{m}^2/\text{C}$ E) $\text{kg}\cdot\text{m}^2/(\text{C}\cdot\text{s}^2)$

14. Which of the following does not have information encoded on it in magnetic form?

A) compact disk B) credit card
 C) VHS tape D) floppy disk
 E) audio cassette

15. Suppose that "particle" beams of the following types were shot through a magnetic field.

- i. alpha particles
- ii. beta particles
- iii. gamma rays
- iv. neutrons

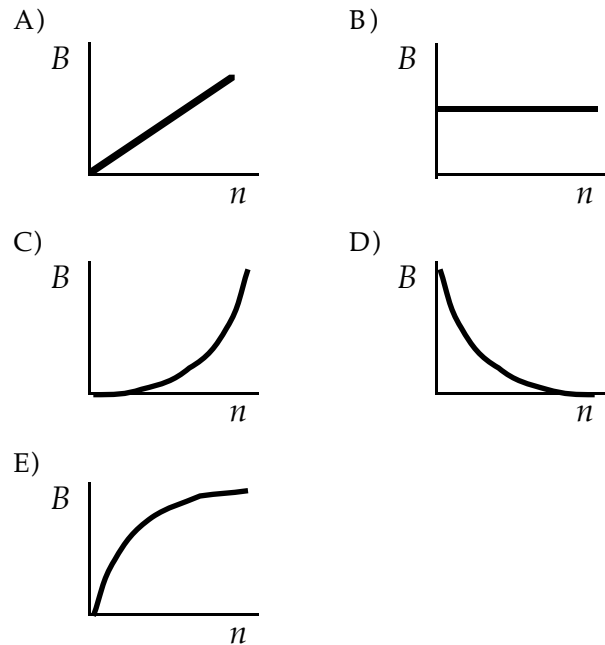
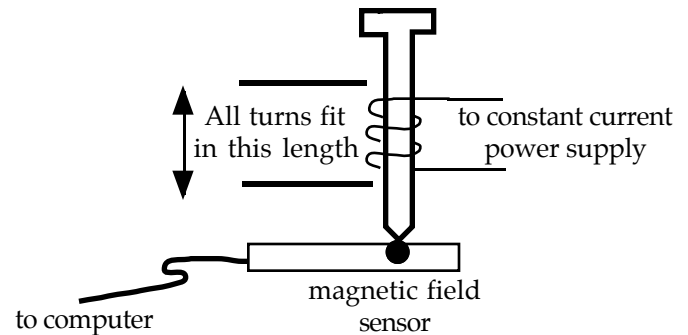
Which beams would not be affected by the field?

A) i only B) ii only C) iii only
 D) iv only E) iii and iv

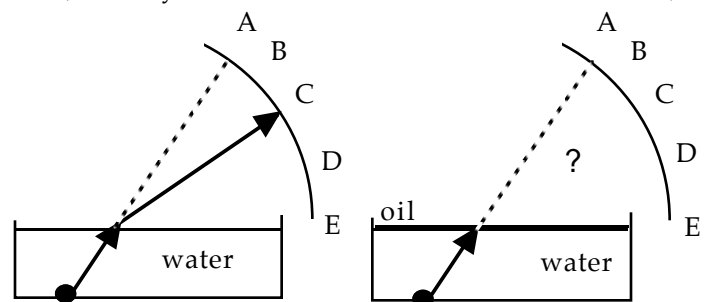
16. Marie Curie was one of the pioneers in the study of radiation. Together with her husband, Pierre Curie, she

A) discovered the alpha particle.
 B) discovered the neutron.
 C) discovered the elements radium and polonium.
 D) invented the cloud chamber.
 E) developed the theory of the nuclear atom.

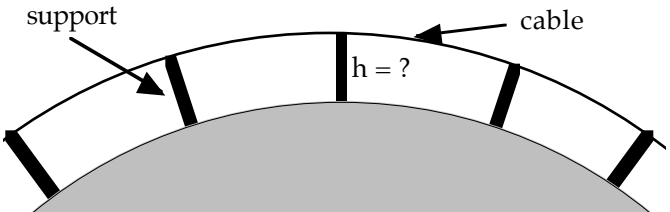
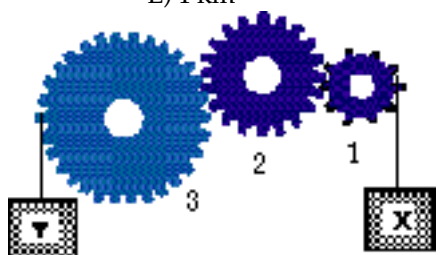
17. Which one of the following graphs most correctly represents the graph of magnetic field strength, B , versus number of turns per unit length, n , as you increase the number of turns wound around the nail?



18. A light ray is shone from the bottom of a tank, through water of index of refraction 1.3 and emerges to hit position C. If a thin layer of transparent oil with index of refraction 1.5 is poured on the surface, which position would the light ray hit now? (You may assume that no internal reflection occurs.)



A) A B) B C) C D) D E) E

19. When light goes from air to water ($n = 1.3$)
 A) the frequency increases
 B) the wavelength increases
 C) the speed increases
 D) the amplitude increases
 E) none of the above
20. A terrestrial telescope has a minimum of three lenses: an objective lens, an erecting lens, and an eyepiece lens. Kelly has three convex lenses of focal lengths 2.0 cm, 10 cm and 100 cm. In order to construct the telescope of maximum magnification, in what order should she put the lenses, from front to eye?
 A) 2.0 cm, 10 cm, 100 cm
 B) 2.0 cm, 100 cm, 10 cm
 C) 100 cm, 10 cm, 2.0 cm
 D) 100 cm, 2.0 cm, 10 cm
 E) 10 cm, 2.0 cm, 100 cm
21. You are sitting in an anchored boat. You see water waves that vibrate with a frequency of 0.30 Hz travelling North. The distance from crest to crest is 8.0 m. You start travelling with a velocity of 2.4 m/s [North]. What is the frequency of the waves hitting the front of your boat now?
 A) 0 Hz B) 0.30 Hz C) 2.4 Hz D) 2.7 Hz E) 3.0 Hz
22. Inside a tube open at both ends, a tiny speaker creates sound that resonates at a fundamental frequency of 1000 Hz. What will be that frequency if the column is closed at both ends?
 A) 500 Hz B) 1000 Hz C) 2000 Hz
 D) 250 Hz E) 4000 Hz
23. A sonar fishfinder on an ocean fishing boat emits a beam with a frequency of 28 kHz. If the wavelength of the sound travelling to the bottom of the ocean is 5.3 cm, calculate the time for the wave to reach the ocean bottom which is 100 m below the boat.
 A) 6.7×10^1 s B) 6.7×10^{-2} s C) 3.4×10^{-2} s
 D) 3.4×10^1 s E) 1.4×10^{-1} s
24. A tuning fork vibrating at an unknown frequency is placed next to a loudspeaker driven at a frequency f . With $f = 1500$ Hz, a beat frequency of 3 Hz is heard. With $f = 1503$ Hz, a beat frequency of 6 Hz is heard. With what other f could you produce a 6 Hz beat frequency?
 A) 1491 Hz B) 1494 Hz C) 1497 Hz
 D) 1509 Hz E) 1515 Hz
25. A sample of radioactive material has atoms with a half life of 1 minute. At 12 Noon, there is an unknown number of atoms in the sample. By 1 PM, there are 1000 original atoms remaining. At what time were there 2000 atoms remaining?
 A) 12:01 B) 12:05 C) 12:20
 D) 12:30 E) 12:59
26. A uniform object is floating in a liquid. $3/5$ of the object's volume is above the surface of the liquid, and $2/5$ is below the surface of the liquid. What is the ratio of the density of the object to the density of the liquid?
 A) 1:5 B) 2:5 C) 3:5 D) 5:3 E) 5:2
27. During the great Ice Storm of 1998, much of Quebec and Ontario along the St. Lawrence River was coated in ice. Which of the following is closest to the number of kilograms of ice which formed during that storm?
 A) 10^6 B) 10^{12} C) 10^{18} D) 10^{24} E) 10^{30}
28. In March, astronomers announced that asteroid 1997 FX11 might collide with Earth in 2028. This was reversed the next day. However simple observation will show that the Moon is much more cratered than the Earth. The main reason for this is:
 A) The Moon is softer than the Earth.
 B) The Moon does not have a magnetic field.
 C) The Moon rotates more slowly than the Earth.
 D) The Moon has no atmosphere.
 E) The Moon travels a greater distance in one year than the Earth.
29. As part of the Internet expansion, it is proposed that a special cable be built that travels completely around the Earth at the equator, whose circumference we will take to be 40 000 km. When the cable arrives from the manufacturer, it is found to be 40 006 km long. The cable cannot be cut so it is decided to place it on elevated supports such that the circumference of the circle formed by the cable matches its uncut length. Approximately how high must each support be?
- 
- Diagram definitely not to scale!
- A) $1 \mu\text{m}$ B) 1 mm C) 1 cm
 D) 1 m E) 1 km
- 30.
- 
- In the gear set above, gear 1 has 10 teeth, gear 2 has 20 teeth and gear 3 has 30 teeth. Each gear axle is fixed, but rotates freely. If hanging mass X can just support the hanging mass Y, what is the mass ratio Y:X?
 A) 1:1 B) 3:2 C) 2:1 D) 3:1 E) 6:1