# Physics 12 – All Concept Review (2018 Curriculum)

## Frames of Reference and Gravitational Attraction

1. Niranj is sitting in the station watching trains go by. Noel is walking down the aisle of a train car that is passing through the station. She is moving in the same direction as the train. If the train is travelling at 9.4 m/s and Noel is walking at 1.1 m/s, how fast is Noel moving from Niranj's frame of reference?

2. SpaceX created a rocket that goes 0.4 C (40% speed of light). If the people on the rocket experience 48 hours of time passing by while travelling at 0.4 C, how much time is passing for stationary observers (relatively speaking) back on Earth?

3. That same rocket from #2 above has a length (when at rest) of 62 m. What would the length appear to be to a stationary observer when the rocket is travelling at 0.4 C?

4. What gravitational force does the moon produce on the Earth if their centres are 3.88 x 10^8 m apart and the moon has a mass of 7.34 x 10^{22} kg?

Circular Motion

For questions #5-#8: An object is moving in a clockwise direction around a circle at constant speed. Use your understanding of the concepts of velocity and acceleration to answer the next four questions. Use the diagram shown at the right.
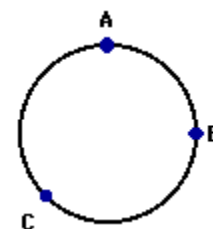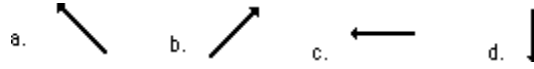

5. Which vector below represents the direction of the velocity vector when the object is located at point B on the circle?
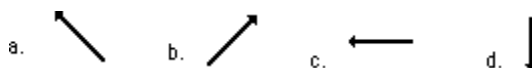

6. Which vector below represents the direction of the acceleration vector when the object is located at point C on the circle?

a.   ↘   b.   ↗   c.   ←   d.   ↓
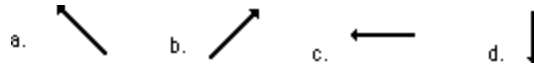
7. Which vector below represents the direction of the velocity vector when the object is located at point C on the circle?

a.   ↘   b.   ↗   c.   ←   d.   ↓

8. Which vector below represents the direction of the acceleration vector when the object is located at point A on the circle?

a.   ↘   b.   ↗   c.   ←   d.   ↓
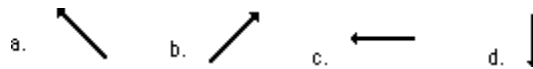
9. A 45 kg halfback makes a turn on the soccer field. The halfback sweeps out a path that is a portion of a circle with a radius of 12 meters. The halfback makes a quarter of a turn around that circle in 2.1 seconds. Determine the speed and acceleration of the halfback.

10. Tyler has his Nintendo Switch tethered to a safety cord. To test it, he starts swinging the Switch around in a circle above his head at a velocity of 2 m/s. The distance between where he is holding the cord and where the cord is attached to the Switch is 1.2 m. The Switch has a mass of 0.3 kg. What is the centripetal force acting on the Switch?

Forces and Equilibrium

11. The following picture is hanging on a wall. Use trigonometry to determine the weight of the picture.

$F_{TENSION}$ = 30 N $F_{TENSION}$ = 30 N

45°   45°
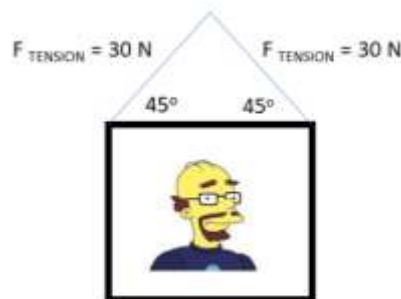
12. Jessica is carrying a huge pile of books (making her total mass with the books 120 kg) and is walking calmly through the quiet space west at 1.3 m/s. Anton, who is running, carrying an amp and three musical instruments (making his total mass 105 kg) moving east at 6 m/s, collides with her. As a result of this inelastic collision, what is the resulting direction and speed of the two people together?

Sound and Light

13. A mosquito's *buzz* is often rated with a decibel rating of 40 dB. Normal conversation is often rated at 60 dB. How many times more intense is normal conversation compared to a mosquito's *buzz*?

    a. 2   b. 20   c. 100   d. 200   e. 400

13. Any two sounds whose wave frequencies exist in a 2:1 ratio are said to be separated by an **octave** and will result in a pleasing sound. In other words, two sound waves sound good when played together if one sound has twice the frequency of the other. Similarly, two sounds with a frequency ratio of 5:4 are said to be separated by an interval of a **third**; such sound waves also sound good when played together.

    Knowing this, would a C (32.7 Hz) and an G (49 Hz) sound good together? What if the G was one octave higher (98 Hz)?

14. Knowing that
    $n_i \bullet \sin(\Theta_i) = n_r \bullet \sin(\Theta_r)$

    where
    Θ_i ("theta i") = angle of incidence
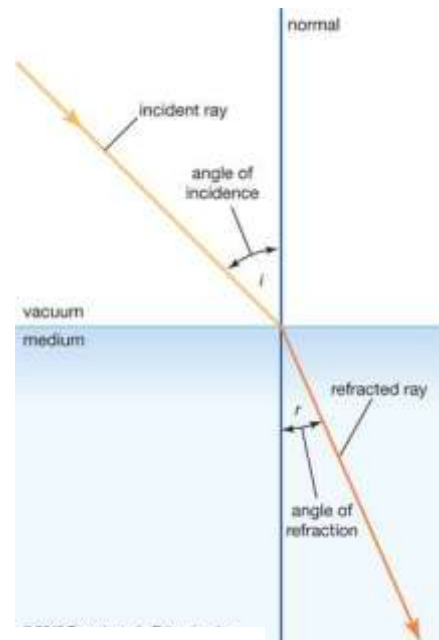 Θ_r ("theta r") = angle of refraction
    n_i = index of refraction of the incident medium
    n_r = index of refraction of the refractive medium

    and knowing that
    the refraction index in a vacuum = 1.0.

If the angle of incidence of a beam of light moving through a vacuum and hitting the surface of a clear acrylic sheet is 45° and the refraction angle is 41°, what is the value of **n** (the refraction index of the acrylic)?

Vectors

15. If Lance's dog, Bonnie Prince Charlie, is pulling forward horizontally with a force of 48 N, and the angle between the horizon and the leash is 28°, how much tension force is in the leash if they are not moving forward or backward?

16. A motorboat traveling 4 m/s, East encounters a current traveling 3.0 m/s, North.

    a. What is the resultant velocity of the motorboat?
    b. If the width of the river is 80 meters wide, then how much time does it take the boat to travel shore to shore?
    c. What distance downstream does the boat reach the opposite shore?

Magnetics and Electricity

17. In a parallel plate apparatus, the plates are 5.00 mm apart. A potential difference of 300.0 V exists between the plates. The electric field strength between the plates is

a) 1.50 V/m

b) 1.00 x 10^2 V/m

c) 1.50 x 10^3 V/m

d) 6.00 x 10^4 V/m

5 mm

300.0 V
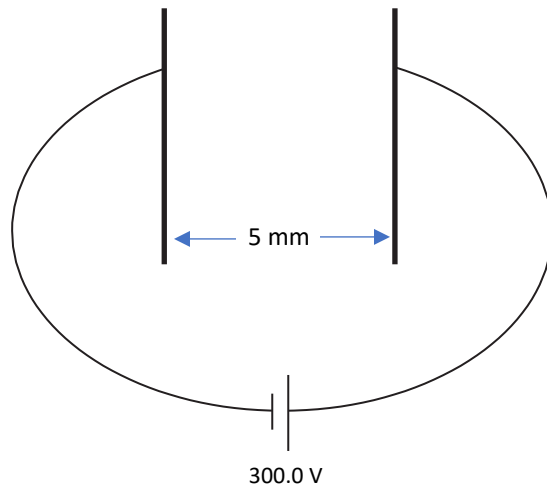
18. If a current of 0.150 mA flows through a calculator for 5.00 minutes, then the amount of charge delivered to the calculator is

a) 0.0450 C

b) 0.000 750 C

c) 45.0 C

d) 0.750 C

19. Describe how the right-hand rule (flat hand) relates the directions of the magnetic field, the velocity, and the magnetic force.

20. Describe at least two ways by which an induced EMF and an induced current can be produced in a coil of wire.