Science Olympiad: Crave the Wave, Test sheet
Name(s):
School:
Town:

Circle the correct answer for problems 1-20.
Each correct answer yields 1 point.

1) Estimate the time it takes for light to get from Earth to Moon?

A: 0.0013 s
B: 0.128 s
C: 1.28 s
D: 128 s
E: 1 hour 28 min

2) Which is the wavelength of red light?

A: 700 m
B: 0.7 m
C: 7 mm
D: 0.7 mm
E: 0.7 μm

3) How fast does sound travel in the atmosphere?

A: 28 m/s
B: 343 m/s
C: 17.1 km/s
D: 59 km/s
E: one light-year per year

4) Compared to Earth, in outer space we can hear

A: better because lack of air causes less loss of sound intensity
B: earlier because lack of air increases sound speed
C: nothing because lack of air inhibits sound propagation
D: at higher frequency because of less gravity
E: at lower frequency because of less gravity

5) The frequency of sound waves from an approaching car

A: is shifted down
B: is shifted up
C: remains unchanged
D: is always doubled
E: is always reduced by a factor of 2

6) If the wavelength of an electromagnetic wave is doubled the frequency

A: also doubles
B: increases by a factor of 4
C: remains unchanged
D: is reduced by a factor of 2
E: is reduced by a factor of 4

7) The physical unit of frequency is named after

A: James Clerk Maxwell
B: Heinrich Hertz
C: Albert Einstein
D: Hermann von Helmholtz
E: Nicolas Tesla

8) Which wave cannot be polarized?

A: sound wave
B: microwave
C: radio wave
D: infrared light
E: a wave on a string

9) Light travels in a certain medium with 75% of its speed in vacuum. What is the index of refraction in this medium?

A: 0.75
B: 0.92
C: 1.00
D: 1.25
E: 1.33

10) Ben is nearsighted and Jill is farsighted. Whose glasses are more suitable to make a fire by converging the light of the sun.

A: Ben's
B: Jill's
C: both would work equally well
D: none would work
E: both would work but Ben's would work better

11) Light propagation in an optical fiber is based on

A: constructive interference
B: destructive interference
C: dispersion of light
D: diffraction
E: total reflection of light

12) The individual colors in a rainbow appear separated because of

A: constructive interference
B: destructive interference
C: dispersion of light
D: diffraction
E: total reflection of light

13) A wave is emitted from a point source. If an observer doubles its distance to the source the intensity of the wave

A: also doubles
B: is reduced by a factor of 2
C: is reduced by a factor of 4
D: remains unchanged
E: is reduced by a factor of 8

14) Which wave is most appropriate to probe the atomic structure of materials, especially of crystals?

A: infrared light waves
B: visible light
C: ultraviolet light
D: radio waves
E: X-rays

15) A machine runs at 2000 rpm (rotations per minute). What is the corresponding frequency?

A: 66.66 s^{-1}
B: 99.99 s^{-1}
C: 2000 s^{-1}
D: 0.5 ms^{-1}
E: 33.33 s^{-1}

16) Two radio antennas transmit the same signal. A radio with the same distance to both antennas receives

A: no signal because of destructive interference
B: a maximal signal due to constructive interference
C: a signal that increases with time
D: a signal that decreases with time
E: a slowly oscillating signal

17) Electromagnetic waves are generated

A: if charges remain at rest
B: if charges move with constant velocity
C: if charges are accelerated
D: only if charges move in a magnetic field
E: if charges move in a magnetic and electric field

18) Visible light arriving at Earth from other galaxies and stars has

A: increased wavelength
B: decreased wavelength
C: no change in wavelength
D: we do not know because the emitted wavelength cannot be measured
E: in some cases increased wavelength and in some cases decreased wavelength

19) Which is refracted most strongly in a glass prism?

A: red light
B: blue light
C: green light
D: yellow light
E: that depends on the type of glass

20) How far is one light-year? (recall the speed of light c=300,000 km/s)

A: 9.4×10^{15} m
B: 9.4×10^{18} m
C: 9.4×10^{21} m
D: 9.4×10^{24} m
E: 9.4×10^{27} m

Tie-breaker: The following problem will only be used to resolve ties. Give a numerical answer as accurately as possible.

At what angle with respect to the normal direction should a fish look in order to see a fisherman far away on the shore? (the index of refraction for water is 1.33)

Write your answer (in degrees) here: