

Brett Robbins Academic Consulting

Physics 30 Practice Test

Unit C: Electromagnetic Radiation

25 Questions

Original practice questions written to the Alberta curriculum, in the style of past diploma examinations. Work through each question, then check your answers with the key at the end.

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, contact Brett for clarification.

Question 1

A weather radar system emits electromagnetic radiation with a wavelength of 2.0 cm.

This radiation is classified as

- | | |
|---------------|--------------------------|
| A) gamma rays | B) ultraviolet radiation |
| C) microwaves | D) infrared radiation |

Question 2

An electromagnetic wave has a frequency of 6.0×10^{14} Hz.

Its wavelength in a vacuum is

- | | |
|---------------------------|---------------------------|
| A) 5.0×10^{-7} m | B) 2.0×10^6 m |
| C) 5.0×10^{-9} m | D) 1.8×10^{23} m |

Question 3

The energy of a photon that has a frequency of 8.6×10^{14} Hz is

(Use $h = 6.63 \times 10^{-34}$ J · s.)

- | | |
|-----------------------------|-----------------------------|
| A) 7.71×10^{-49} J | B) 5.70×10^{-19} J |
| C) 5.70×10^{-20} J | D) 1.16×10^{-18} J |

Question 4

When a beam of light passes from air into glass, one property of the light does not change.

That property is its

- A) speed
- B) wavelength
- C) frequency
- D) direction of travel

Question 5

A metal surface is illuminated by monochromatic light with a frequency above the threshold frequency.

If the intensity of the light is increased while its frequency is kept constant, then

- A) the maximum kinetic energy of the photoelectrons increases
- B) the number of photoelectrons emitted per second increases
- C) the stopping voltage increases
- D) the threshold frequency of the metal decreases

Question 6

Light travelling in air strikes a flat surface of water ($n = 1.33$) at an angle of incidence of 40.0° .

The angle of refraction, to the nearest tenth of a degree, is ____ degrees.

Question 7

Yellow light that has a wavelength of 5.89×10^{-7} m in air enters glass ($n = 1.52$).

The wavelength of this light inside the glass is

- A) 5.89×10^{-7} m B) 8.95×10^{-7} m
C) 3.88×10^{-7} m D) 2.55×10^{-7} m

Question 8

The work function of a metal is 2.30 eV.

The maximum wavelength of light that can eject photoelectrons from this metal, to the nearest nanometre, is ____

(Use $h = 6.63 \times 10^{-34}$ J · s, $c = 3.00 \times 10^8$ m/s, and $1 \text{ eV} = 1.60 \times 10^{-19}$ J.)

Question 9

In a Michelson – type experiment to measure the speed of light, a rotating mirror with 8 sides is used with a stationary mirror placed 25.0 km away. The light signal is next detected

when the rotating mirror has turned through $\frac{1}{8}$ of a revolution during the round trip of the light.

The rotation frequency at which this first occurs is

- A) 750 rev/s B) 375 rev/s
C) 1.50×10^3 rev/s D) 3.00×10^3 rev/s

Question 10

An object that is 1.6 m tall is located 6.0 m in front of a concave mirror that has a focal length of 2.0 m.

The height and orientation of the image are

A) Height : 0.80 m

Orientation : erect

B) Height : 0.80 m

Orientation : inverted

C) Height : 3.2 m

Orientation : inverted

D) Height : 0.53 m

Orientation : erect

Question 11

Light with a wavelength of 4.00×10^{-7} m is incident on a metal that has a work function of 2.14 eV.

The stopping voltage for the emitted photoelectrons is

(Use $h = 6.63 \times 10^{-34}$ J · s, $c = 3.00 \times 10^8$ m/s, and $1 \text{ eV} = 1.60 \times 10^{-19}$ J.)

A) 2.14 V

B) 3.11 V

C) 5.25 V

D) 0.97 V

Question 12

An X – ray photon has a wavelength of 2.40×10^{-11} m.

The magnitude of the momentum of this photon is

(Use $h = 6.63 \times 10^{-34}$ J · s.)

A) 2.76×10^{-23} kg · m/s

B) 7.96×10^{-31} kg · m/s

C) 2.76×10^{-22} kg · m/s

D) 3.62×10^{22} kg · m/s

Question 13

In a Compton scattering event, an X – ray photon collides with a stationary electron and is scattered.

Compared with the incident photon, the scattered photon has

A) Energy : greater

Wavelength : shorter

B) Energy : greater

Wavelength : longer

C) Energy : less

Wavelength : shorter

D) Energy : less

Wavelength : longer

Question 14

An atom makes a transition from an energy level of -1.51 eV to an energy level of -3.40 eV, emitting a photon.

Expressed in the form $a.bc \times 10^{14}$ Hz, the frequency of the photon has $a.bc = \underline{\hspace{1cm}}$.

(Use $h = 6.63 \times 10^{-34}$ J · s and $1 \text{ eV} = 1.60 \times 10^{-19}$ J.)

Question 15

In the photoelectric effect, a graph of the maximum kinetic energy of the photoelectrons

versus the frequency of the incident light is a straight line. The slope of this line is equal to

A) the threshold frequency

B) the work function

C) the elementary charge

D) Planck constant

Question 16

A ray of light travels in glass that has an index of refraction of 1.52.

The critical angle for this glass – to – air boundary is

- A) 48.8°
- B) 41.1°
- C) 33.0°
- D) 65.3°

Question 17

A beam of white light passes through a glass prism and separates into a spectrum.

The violet light is deviated (bent) more than the red light because

- A) the index of refraction of glass is greater for violet light than for red light
- B) violet light travels faster through glass than red light does
- C) violet light has a lower frequency than red light
- D) the glass absorbs more red light than violet light

Question 18

Photons with a frequency of 1.20×10^{15} Hz strike a metal whose threshold frequency is 8.00×10^{14} Hz.

The stopping voltage, to the nearest hundredth of a volt, is ____ V.

(Use $h = 6.63 \times 10^{-34}$ J · s and $e = 1.60 \times 10^{-19}$ C.)

Question 19

Light with a frequency above the threshold frequency of a metal is shone on the metal.

The frequency of the light is then increased while the intensity is kept constant.

As a result, the number of photoelectrons emitted per second and the maximum kinetic energy of the photoelectrons

A) Rate : increases

Maximum kinetic energy : increases

B) Rate : decreases

Maximum kinetic energy : increases

C) Rate : decreases

Maximum kinetic energy : unchanged

D) Rate : unchanged

Maximum kinetic energy : increases

Question 20

An X – ray photon with a wavelength of 1.06×10^{-10} m strikes a stationary electron and is scattered.

The scattered photon has a wavelength of 1.20×10^{-10} m. The kinetic energy gained by the electron is

(Use $h = 6.63 \times 10^{-34}$ J · s and $c = 3.00 \times 10^8$ m/s.)

A) 1.66×10^{-15} J

B) 1.88×10^{-15} J

C) 2.19×10^{-16} J

D) 4.15×10^{-16} J

Question 21

Which of the following sources produces a line emission spectrum?

- A) the filament of an incandescent bulb
- B) a sample of molten iron
- C) a hot, low – density gas in a discharge tube
- D) white light after it passes through a cool gas

Question 22

Diamond has an index of refraction of 2.42.

Expressed in the form $a.bc \times 10^8$ m/s, the speed of light in diamond has $a.bc = \underline{\hspace{1cm}}$.

(Use $c = 3.00 \times 10^8$ m/s in a vacuum.)

Question 23

Which of the following phenomena can be explained only by the particle model of light?

- | | |
|----------------|-----------------------------|
| A) reflection | B) refraction |
| C) diffraction | D) the photoelectric effect |

Question 24

When light with a wavelength of 3.50×10^{-7} m strikes a metal surface, the photoelectrons emitted have a maximum kinetic energy of 1.40 eV. The work function of the metal is

(Use $h = 6.63 \times 10^{-34}$ J · s, $c = 3.00 \times 10^8$ m/s, and $1 \text{ eV} = 1.60 \times 10^{-19}$ J.)

- | | |
|------------|------------|
| A) 2.15 eV | B) 4.95 eV |
| C) 3.55 eV | D) 1.40 eV |

Question 25

A metal has a threshold wavelength of 6.20×10^{-7} m. Light with a wavelength of 4.50×10^{-7} m strikes the metal.

Expressed in the form $a.b \times 10^5$ m/s, the maximum speed of the emitted photoelectrons has $a.b = \underline{\hspace{1cm}}$.

(Use $h = 6.63 \times 10^{-34}$ J $\cdot$ s, $c = 3.00 \times 10^8$ m/s, $1 \text{ eV} = 1.60 \times 10^{-19}$ J, and $m_e = 9.11 \times 10^{-31}$ kg.)

Answer Key

- | | | |
|---------|----------|----------|
| 1. C | 10. B | 19. B |
| 2. A | 11. D | 20. C |
| 3. B | 12. A | 21. C |
| 4. C | 13. D | 22. 1.24 |
| 5. B | 14. 4.56 | 23. D |
| 6. 28.9 | 15. D | 24. A |
| 7. C | 16. B | 25. 5.2 |
| 8. 540 | 17. A | |
| 9. A | 18. 1.66 | |

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