This year there were 26 out of 85 possible credits or about 31% of the test

23 Increasing the amplitude of a sound wave produces a sound with

(1) lower speed (3) shorter wavelength
(2) higher pitch (4) greater loudness

24 The product of a wave's frequency and its period is

(1) one (3) its wavelength
(2) its velocity (4) Planck's constant

25 A periodic wave having a frequency of 5.0 hertz and a speed of 10. meters per second has a wavelength of

(1) 0.50 m (3) 5.0 m
(2) 2.0 m (4) 50. m

26 An electromagnetic wave traveling through a vacuum has a wavelength of 1.5×10^{-1} meter. What is the period of this electromagnetic wave?

(1) 5.0×10^{-10} s (3) 4.5×10^{7} s
(2) 1.5×10^{-1} s (4) 2.0×10^{9} s

27 A ray of light ($f = 5.09 \times 10^{14}$ Hz) traveling in air strikes a block of sodium chloride at an angle of incidence of 30.°. What is the angle of refraction for the light ray in the sodium chloride?

(1) 19° (3) 40.°
(2) 25° (4) 49°

28 The speed of a ray of light traveling through a substance having an absolute index of refraction of 1.1 is

(1) 1.1×10^{8} m/s (3) 3.0×10^{8} m/s
(2) 2.7×10^{8} m/s (4) 3.3×10^{8} m/s

29 Resonance occurs when one vibrating object transfers energy to a second object causing it to vibrate. The energy transfer is most efficient when, compared to the first object, the second object has the same natural
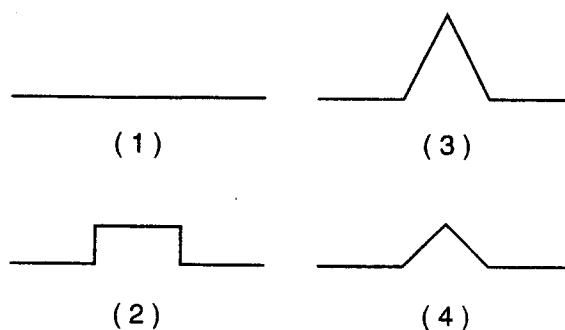
(1) frequency (3) amplitude
(2) loudness (4) speed

30 A subatomic particle could have a charge of

(1) 5.0×10^{-20} C (3) 3.2×10^{-19} C
(2) 8.0×10^{-20} C (4) 5.0×10^{-19} C

31 Two pulses traveling in the same uniform medium approach each other, as shown in the diagram below.

Which diagram best represents the superposition of the two pulses?

(1)   (3)

(2)   (4)

32 A police car traveling at a speed of 30.0 meters per second sounds its siren, which has a frequency of 1.00×10^{3} hertz. As the police car approaches a stationary pedestrian, the pedestrian detects a siren frequency of

(1) 30.0 Hz (3) 1.00×10^{3} Hz
(2) 9.19×10^{2} Hz (4) 1.10×10^{3} Hz

33 A variable-frequency light source emits a series of photons. As the frequency of the photon increases, what happens to the energy and wavelength of the photon?

(1) The energy decreases and the wavelength decreases.
(2) The energy decreases and the wavelength increases.
(3) The energy increases and the wavelength decreases.
(4) The energy increases and the wavelength increases.

34 Which diagram best represents the shape and direction of a series of wave fronts after they have passed through a small opening in a barrier?

(1)   (2)   (3)   (4)
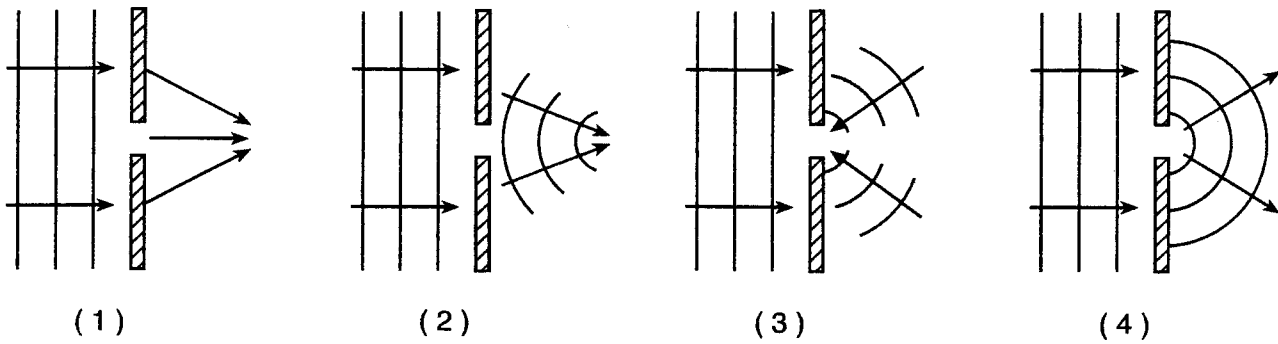
35 The diagram below represents the sequence of events (steps 1 through 10) resulting in the production of a D⁻ meson and a D⁺ meson. An electron and a positron (antielectron) collide (step 1), annihilate each other (step 2), and become energy (step 3). This energy produces an anticharm quark and a charm quark (step 4), which then split apart (steps 5 through 7). As they split, a down quark and an antidown quark are formed, leading to the final production of a D⁻ meson and a D⁺ meson (steps 8 through 10).
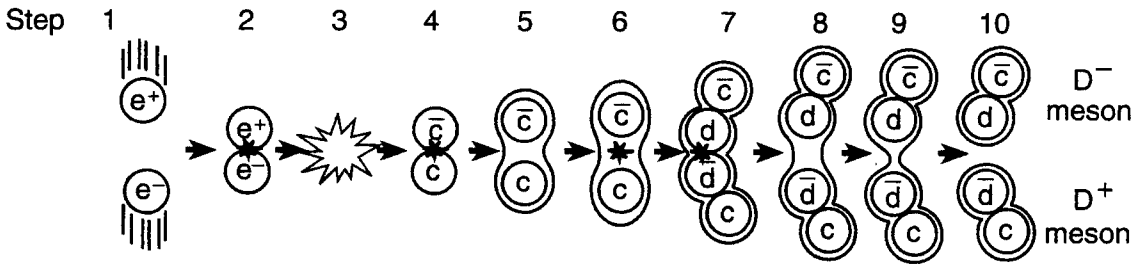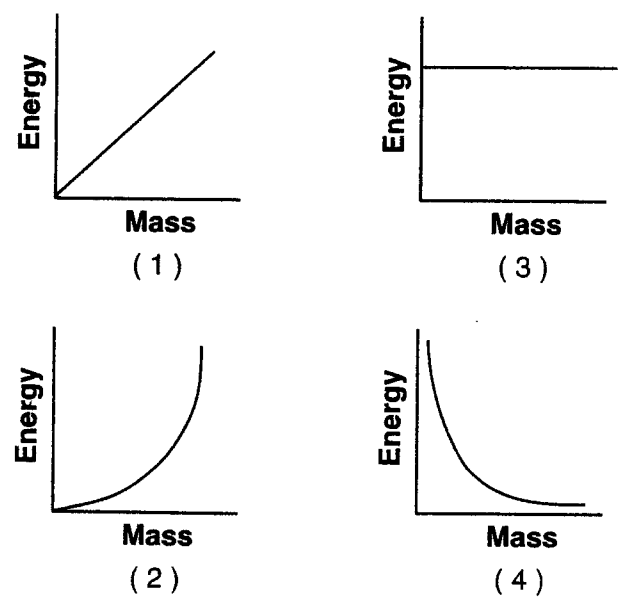

Adapted from: Electon/Positron Annihilation http:/www.particleadventure.org/frameless/eedd.html 7/23/2007

Which statement best describes the changes that occur in this sequence of events?

(1) Energy is converted into matter and then matter is converted into energy.
(2) Matter is converted into energy and then energy is converted into matter.
(3) Isolated quarks are being formed from baryons.
(4) Hadrons are being converted into leptons.
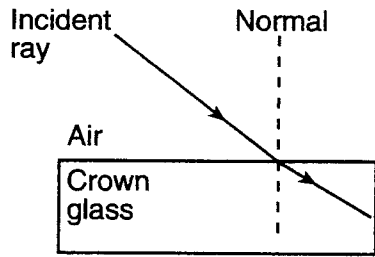
45 A particle unaffected by an electric field could have a quark composition of

(1) *css*   (3) *udc*
(2) *bbb*   (4) *uud*
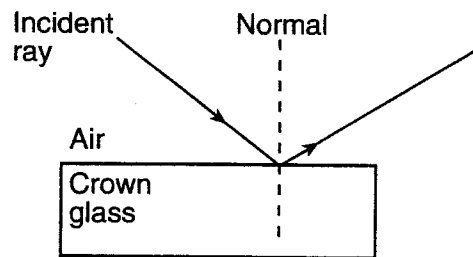
47 A sound wave has a wavelength of 5.5 meters as it travels through air at STP. What is the wavelength of this sound in a medium where its speed is 1324 meters per second?
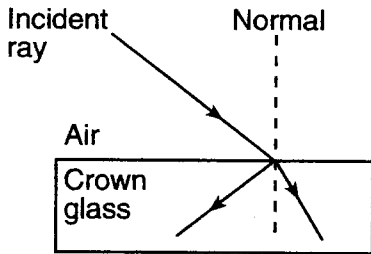
(1) 1.4 m   (3) 14 m
(2) 2.2 m   (4) 22 m

48 Which graph best represents the relationship between energy and mass when matter is converted into energy?

(1)   (3)

(2)   (4)

49 Which diagram best represents the behavior of a ray of monochromatic light in air incident on a block of crown glass?

Incident ray   Normal

Air
Crown glass

(1)

Incident ray   Normal

Air
Crown glass

(3)

Incident ray   Normal

Air
Crown glass

(2)

Incident ray   Normal

Air
Crown glass
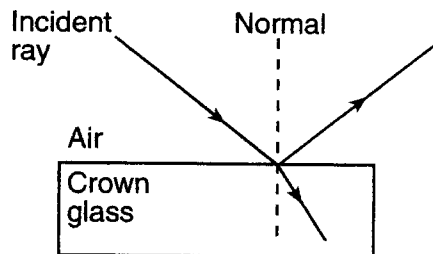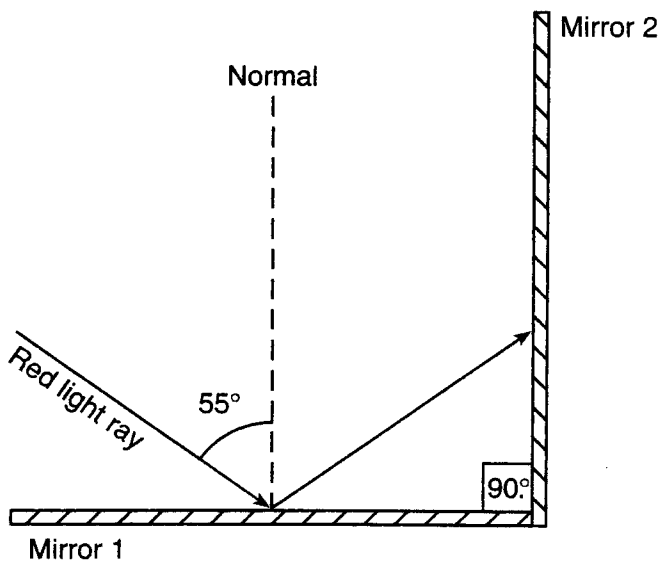
(4)

Base your answers to questions 56 and 57 on the information and diagram below.

Two plane mirrors are positioned perpendicular to each other as shown. A ray of monochromatic red light is incident on mirror 1 at an angle of 55°. This ray is reflected from mirror 1 and then strikes mirror 2.

Mirror 2

Normal

Red light ray

55°

90°

Mirror 1

62 A tau lepton decays into an electron, an electron antineutrino, and a tau neutrino, as represented in the reaction below.

$$\tau \rightarrow e + \bar{v}_e + v_\tau$$
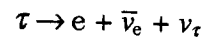
On the equation *in your answer booklet*, show how this reaction obeys the Law of Conservation of Charge by indicating the amount of charge on each particle. [1]

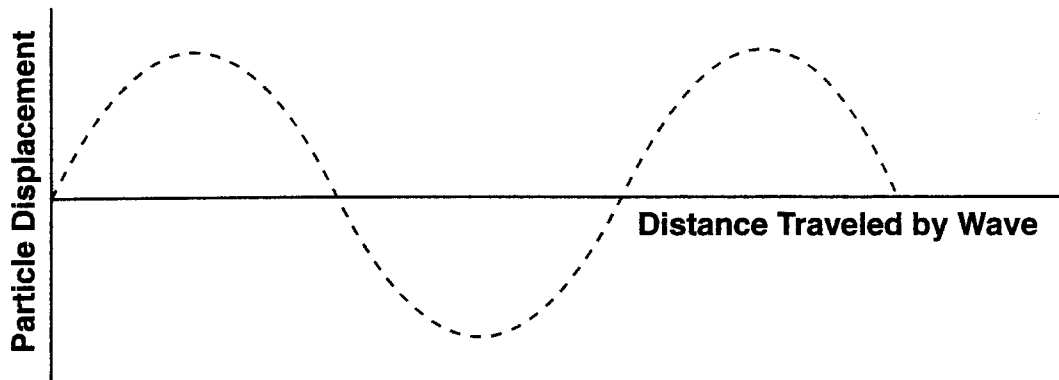56 Determine the angle at which the ray is incident on mirror 2. [1]

57 On the diagram *in your answer booklet*, use a protractor and a straightedge to draw the ray of light as it is reflected from mirror 2. [1]

68 The diagram below represents a periodic transverse wave traveling in a uniform medium.

Particle Displacement

Distance Traveled by Wave

On the diagram *in your answer booklet*, draw a wave having *both* a smaller amplitude and the same wavelength as the given wave. [2]

Base your answers to questions 69 and 70 on the information and diagram below.

A 1.50×10^{-6}-meter-long segment of an electromagnetic wave having a frequency of 6.00×10^{14} hertz is represented below.

$\longleftarrow$ 1.50×10^{-6} m $\longrightarrow$
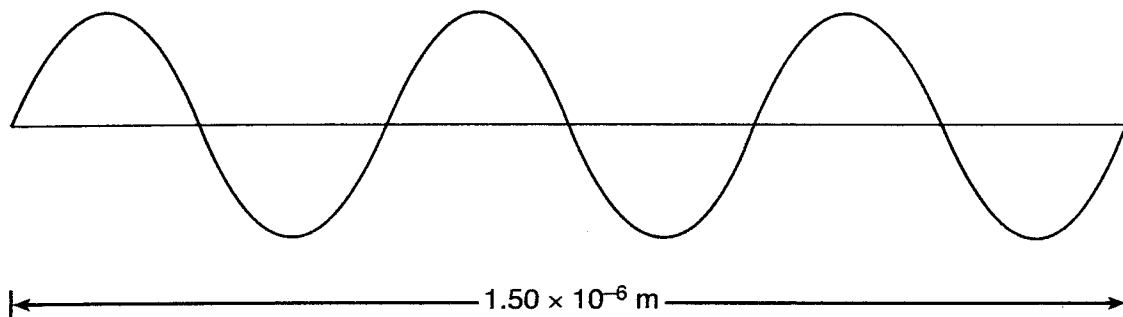
69 On the diagram *in your answer booklet*, mark *two* points on the wave that are in phase with each other. Label each point with the letter *P*. [1]

70 According to the *Reference Tables for Physical Setting/Physics*, which type of electromagnetic wave does the segment in the diagram represent? [1]

Base your answers to questions 75 and 76 on the information below.

In a mercury atom, as an electron moves from energy level *i* to energy level *a*, a single photon is emitted.

75 Determine the energy, in electronvolts, of this emitted photon. [1]

76 Determine this photon's energy, in joules. [1]

Answer Sheet
Waves, Light, Modern Review
   January 2008

Name _____

22 _____   31 _____   Part B
23 _____   32 _____
24 _____   33 _____   45 _____   49 _____
25 _____   47 _____
26 _____   34 _____   48 _____
27 _____   35 _____
28 _____
29 _____
30 _____
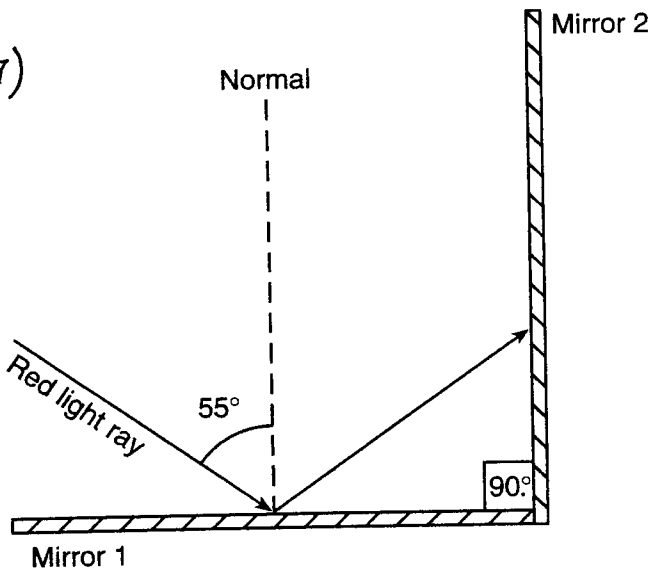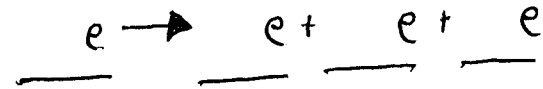
56) $\not{\lambda}$ = _____ °

57)

Mirror 2

Normal

Red light ray   55°

90°

Mirror 1

62)

$e \longrightarrow$ _____ $e +$ _____ $e +$ _____ e

68)

Particle Displacement

Distance Traveled by Wave
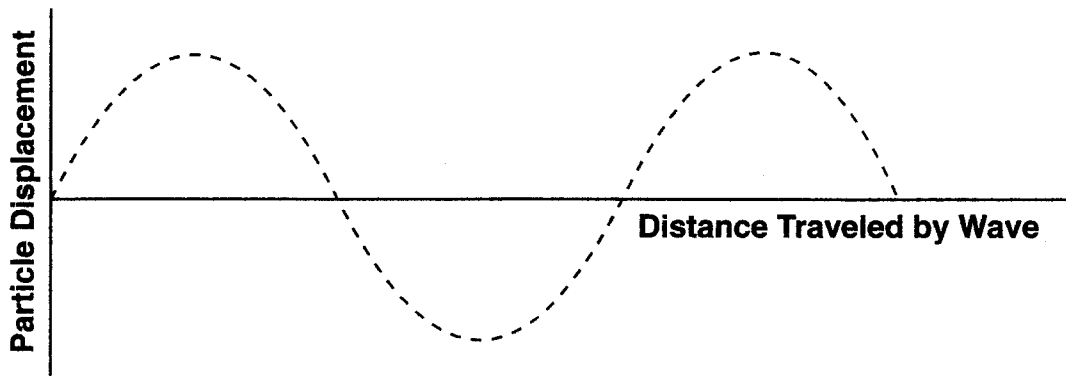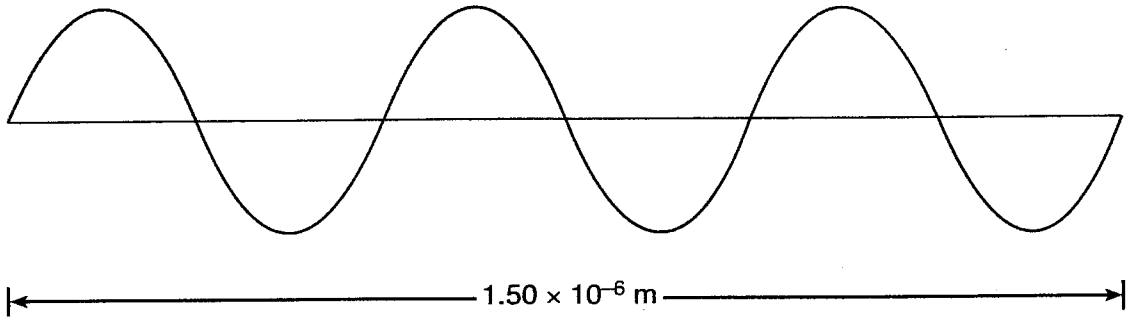
Base your answers to questions 69 and 70 on the information and diagram below.

A 1.50×10^{-6}-meter-long segment of an electromagnetic wave having a frequency of 6.00×10^{14} hertz is represented below.

(69)

|←————————————— 1.50×10^{-6} m ——————————————→|

(70) _____

_____

(75) Energy = _____ eV

(76) Energy = _____ joules

Credits of 26	%	Credits of 85	Scaled Regents Score
26	100.0	85.0	100
25	96.2	81.7	97
24	92.3	78.5	94
23	88.5	75.2	90
22	84.6	71.9	87
21	80.8	68.7	85
20	76.9	65.4	81
19	73.1	62.1	78
18	69.2	58.8	75
17	65.4	55.6	73
16	61.5	52.3	69
15	57.7	49.0	66
14	53.8	45.8	62
13	50.0	42.5	59
12	46.2	39.2	55
11	42.3	36.0	51
10	38.5	32.7	48
9	34.6	29.4	43
8	30.8	26.2	39
7	26.9	22.9	35
6	23.1	19.6	31
5	19.2	16.3	25
4	15.4	13.1	21
3	11.5	9.8	16
2	7.7	6.5	12

22	3	31	3	
23	4	32	4	
24	1	33	3	
25	2			
26	1	34	4	
27	1	35	2	
28	2			
29	1			
30	3			

Part B

45 __1__
47 __4__
48 __1__

49 __4__

56) $\not{\ }$ = __35__ ° ($\pm 2°$)

57)

Mirror 2

Normal

reflected From mirror 2

Red light ray

55°

90°

Mirror 1

62)

$-1e \longrightarrow -1e + 0e + 0e$

68)

Particle Displacement

Distance Traveled by Wave

Base your answers to questions 69 and 70 on the information and diagram below.

A 1.50×10^{-6}-meter-long segment of an electromagnetic wave having a frequency of 6.00×10^{14} hertz is represented below.

(69)

P   P

|← —————————— 1.50×10^{-6} m —————————— →|

Visible   or
(70) Green light

(75) Energy = 8.82 eV

(76) Energy = 1.41×10^{-18} joules

Credits of 26	%	Credits of 85	Scaled Regents Score
26	100.0	85.0	100
25	96.2	81.7	97
24	92.3	78.5	94
23	88.5	75.2	90
22	84.6	71.9	87
21	80.8	68.7	85
20	76.9	65.4	81
19	73.1	62.1	78
18	69.2	58.8	75
17	65.4	55.6	73
16	61.5	52.3	69
15	57.7	49.0	66
14	53.8	45.8	62
13	50.0	42.5	59
12	46.2	39.2	55
11	42.3	36.0	51
10	38.5	32.7	48
9	34.6	29.4	43
8	30.8	26.2	39
7	26.9	22.9	35
6	23.1	19.6	31
5	19.2	16.3	25
4	15.4	13.1	21
3	11.5	9.8	16
2	7.7	6.5	12