NOVA SCOTIA
Department of Education
Testing and Evaluation

NOVA SCOTIA EXAMINATIONS

PHYSICS 12

JANUARY 2003

MARKING GUIDE

January 2003 Physics 12
Multiple Choice Answers
Total Value 40

	SCO		SCO
1. **A**	ACP 1	21. **A**	328–1
2. **B**	ACP 1	22. **B**	329–3
3. **A**	ACP 1	23. **D**	329–1
4. **A**	ACP 1	24. **D**	329–1
5. **A**	ACP 1	25. **C**	327–11
6. **B**	213–5 SHM	26. **C**	327–11
7. **A**	213–5 SHM	27. **B**	115–3 deB
8. **A**	327–4	28. **D**	327–9
9. **B**	325–6	29. **C**	326–9
10. **D**	325–6	30. **B**	326–9
11. **C**	325–6	31. **C**	329–4
12. **C**	325–6	32. **C**	329–4
13. **D**	325–12	33. **B**	329–4
14. **C**	325–13	34. **A**	329–6
15. **B**	326–3	35. **A**	329–4
16. **C**	326–3	36. **B**	115–5 fission
17. **A**	215–2 Ug	37. **A**	329–4
18. **A**	328–5	38. **B**	115–5 fission
19. **C**	328–9	39. **D**	329–6
20. **B**	328–7	40. **C**	329–4

41. Note to markers: This question should provide an opportunity to see whether students organize and solve expressions before replacing variables with data. The final answer should not receive more than 2 out of the total five marks.

The horizontal components of the forces in rope 1 and rope 3 must be equal in magnitude, if the signs are in static equilibrium.

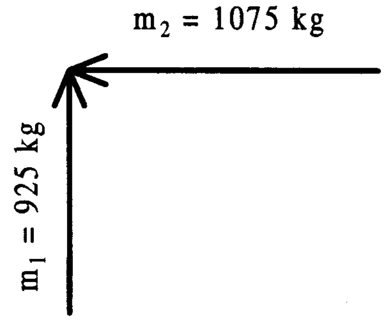
$$F_{x1} = F_{x2}$$

$$\frac{m_1 g}{\tan 60°} = \frac{m_2 g}{\tan 40.9°}$$

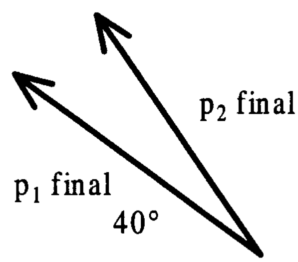
$$m_2 = m_1 \frac{\tan 40.9°}{\tan 60.0°} = 1.25 \text{ kg}$$

total value = 5

42. before:



after: m_1 has a velocity of 52.0 km/hr, 40.0° N of W, and m_2 has a speed of 40.0 km/hr, 50.0° N of W.



diagrams and interpretation
value: 2

The sum of the components of the momenta is the same before and after the collision.

p_1 after = 925 kg x 52.0 km/hr = 4.81 x 10^4 kg·km/hr at 40.0° N of W.

p_{1x} (after) = (4.81 x 10^4 kg-km/hr)(cos 40.0°) = 3.68 x 10^4 kg-km/hr, W
p_{1y} (after) = (4.81 x 10^4 kg-km/hr)(sin 40.0°) = 3.09 x 10^4 kg-km/hr, N

p_2 after = 1075 kg x 40.0 km/hr = 4.30 x 10^4 kg-km/hr at 50.0° N of W.

p_{2x} (after) = (4.30 x 10^4 kg-km/hr)(cos 50.0°) = 2.76 x 10^4 kg-km/hr, W
p_{2y} (after) = (4.30 x 10^4 kg-km/hr)(sin50.0°) = 3.29 x 10^4 kg-km/hr, N

$\sum p_x$ = 6.44 x 10^4 kg-km/hr, W before and after **value: 1**
$\sum p_y$ = 6.38 x 10^4 kg-km/hr, N before and after **value: 1**

$$\therefore v_2 \text{ before} = p_x / m_2 = \frac{6.44\times10^4 \text{ kg-km/hr}}{1075 \text{ kg}} = 60.0 \text{ km/hr, W}$$ **value: 2**

$$v_1 \text{ before} = p_y / m_1 = \frac{6.38\times10^4 \text{ kg-km/hr}}{925 \text{ kg}} = 69.0 \text{ km/hr, N}$$ **value: 2**

43. Initial velocity: 20.0 m/s, 37.0° from the horizontal.

A) v_x = 20.0 m/s (cos 37.0°) = 16.0 m/s to the right **value: 1/2**
v_y = 20.0 m/s (sin 37.0°) = 12.0 m/s up **value: 1/2**

$$a = \frac{v_f - v_i}{\Delta t}$$

$$\Delta t_{up} = \frac{v_f - v_i}{a} = \frac{0 - 12\text{m/s}}{-9.80\text{m/s}^2} = 1.22 \text{ s}$$ **value: 1**

total time in air = 2.44 s

value: 1

B) $\Delta d = v_x \Delta t$ = (16.0 m/s)(2.44 s) = 39.0 m is the range **value: 2**

C) for second half of flight, from top to bottom

$$\Delta d = v_y \Delta t + \tfrac{1}{2} a \Delta t^2 = 0 + \tfrac{1}{2}(-9.80 \text{ m/s}^2)(1.22 \text{ s})^2 = -7.29 \text{ m (down)}$$

Therefore the height reached by the ball is 7.29 m **value: 2** **(v^2 formula varies)**

D) The horizontal component of the velocity as it reaches the ground is 16.0 m/s, right.

$$v_f = v_i + a\Delta = 0 + (-9.80\text{m/s}^2)(1.22 \text{ s}) = -12.0 \text{ m/s}$$

This is the same magnitude as the vertical component at launch, but in the downward direction. **value: 2**

44.

A)

$$\frac{r_e^{\,3}}{T_e^{\,2}} = \frac{r_o^{\,3}}{T_o^{\,2}}$$

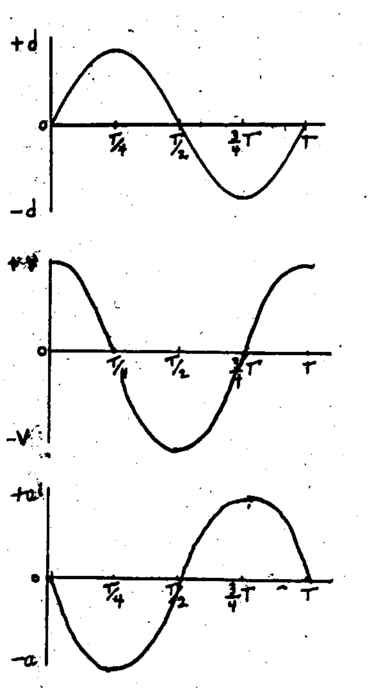
value: 3

$$T_o = \sqrt{\frac{r_o^{\,3} \times T_e^{\,2}}{r_e^{\,3}}} = \sqrt{\frac{(10r_e)^3 (365 \text{ days})^2}{r_e^{\,3}}} = 11500 \text{ days}$$

B) $$v_c = \frac{2\pi r}{T} = \frac{2\pi(10 \times 1.50 \times 10^{11}}{11500 \text{ days}(24\text{hr/day})(3600\text{s/hr})} = 9490 \text{ m/s}$$ **value: 2**

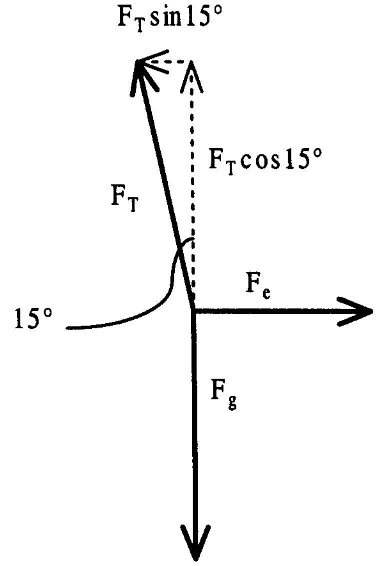
45. The radius of Jupiter is larger than the radius of the Earth. Gravitational force is related inversely to distance **squared.** The radius of Jupiter would be needed to provide a calculated answer. **value: 3**

46.



value: 2

47. A)



The diagram shows the forces acting on the right-hand pith ball.

$$F_T \cos 15° = F_g$$

$$F_T = \frac{F_g}{\cos 15°} = \frac{(2.0\times10^{-3}\ \text{kg})(9.80\ \text{m/s}^2)}{.966} = 0.020\text{N}$$

value: 2

B)

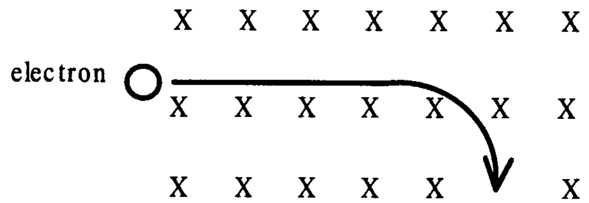
$$F_e = F_T \sin 15° = \frac{kq^2}{r^2}$$

value: 5

$$q = \sqrt{\frac{F_T \sin 15° r^2}{k}} = \sqrt{\frac{(0.020\text{N})(\sin 15°)(0.15\ \text{m})^2}{9.0\times10^9\ \text{Nm}^2/\text{C}^2}} = 1.1\times10^{-7}\ \text{C}$$

NOTE: mark allocation will vary, depending on the approach the student takes. For example, many students may find F_e as a separate step, and then use that value in the final solution.

48. A) The electron will curve to the right (clockwise) in an approximately circular curve.



value: 1

B)

$$F_m = F_c$$

$$qvB = \frac{mv^2}{r}$$

$$r = \frac{mv}{qB} = \frac{(9.11\times10^{-31}\ \text{kg})(5.0\times10^{5}\ \text{m/s})}{(1.6\times10^{-19}\ \text{C})(4.0\times10^{-2}\ \text{T})} = 7.1\times10^{-5}\ \text{m}$$

value: 3

C) Since the force is perpendicular to the motion, the speed will not change, and therefore the kinetic energy will remain the same. value: 2

49. A)

$$E = -\frac{13.6}{n^2}\text{eV}$$

$$E_2 = -\frac{13.6}{2^2} = -3.4\text{eV}$$

$$E_3 = -\frac{13.6}{3^2} = -1.5\text{eV}$$

since 1 eV = 1.6×10^{-19} J, $E_2 = -5.4\times10^{-19}$ J and $E_3 = -2.4\times10^{-19}$ J

and $\Delta E = (+)3.0\times10^{-19}$ J

value: 3

49. B)

$$E = \frac{hc}{\lambda} \qquad \lambda = \frac{hc}{E} = \frac{(6.626\times10^{-34}\,\text{Js})(3.0\times10^{8}\ \text{m/s})}{3.0\times10^{-19}\ \text{J}} = 660\ \text{nm}$$

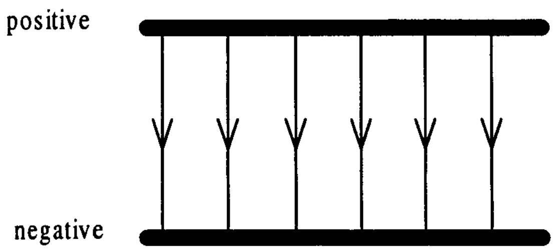
value: 2

This is in the visible range of 400-750 nm

50. **Case Study**

A) Air friction supplied the force by which electrons were stripped from droplets. **value: 1**

B)



The sketch should show a straight line field directed from positive to negative.

value: 1

C) $E = \dfrac{F_e}{q}$ $\quad F_e = qE = (4.8\times10^{-19}\ \text{C})(2.62\times10^{6}\ \text{N/C}) = 1.26\times10^{-12}\ \text{N}$

value: 1

D)

value: 1

E) $E = \dfrac{F_e}{q}$ $\quad F_e = F_g = mg$ $\quad$ therefore $E = \dfrac{mg}{q}$ **value: 2**

F) $\dfrac{mg}{q} = \dfrac{V}{d}$ $\quad q = \dfrac{dmg}{V}$ **value: 1**

G) $$q = \frac{dmg}{V} = \frac{(1.60\times10^{-3}\ \text{m})(3.00\times10^{-15}\ \text{kg})(9.80\ \text{m/s}^2)}{4200\ \text{V}} = 1.12\times10^{-20}\ \text{C}$$

value: 1

H) No, selecting data to prove a point is not acceptable. If a clear reason to discount certain trials existed, the trials deleted and the reasoning should be published in a report for peer review. **value: 2**