



NOVA SCOTIA EXAMINATIONS

PHYSICS 12

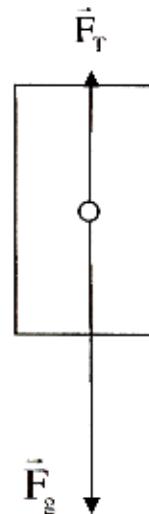
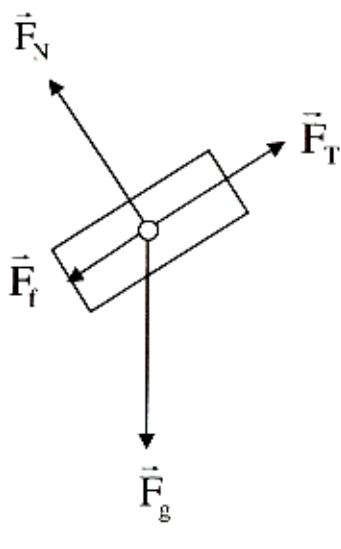
JUNE 2005

MARKING GUIDE

June 2005 Physics 12
Selected Response Questions Answer Key (Corrected)
Total Value 40

<u>SCO</u>	<u>SCO</u>
1. A ACP-1	21. C 328-7
2. C ACP-1	22. D 328-7
3. A ACP-1	23. B 328-7
4. C ACP-1	24. B 328-7
5. A ACP-1	25. C 328-5
6. C ACP-1	26. D 328-5
7. C 326-3	27. A 328-6
8. A 326-3	28. B 328-9
9. D 326-3	29. B 328-9
10. D 326-4	30. C 328-9
11. B 326-3	31. B 328-9
12. D 325-6	32. B 328-9
13. B 325-6	33. D 329-1
14. D 325-6	34. D 327-10
15. <u>B</u> 327-4 A	35. B 327-10
16. B 327-4	36. C 327-10
17. A 327-4	37. B 327-10
18. C ACP-3	38. D 327-10
19. C 328-2	39. D 329-4
20. C 328-5	40. C 115-5 (reactors)

41. Free body diagrams



value: 2

Mass on incline moves uphill $\vec{a} = +\vec{a}$

Hanging mass moves downward $\vec{a} = -\vec{a}$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$\vec{F}_f + \vec{F}_{g\parallel} + \vec{F}_T = m\vec{a}$$

$$-\mu mg \times \cos\theta + (-mg \times \sin\theta) + F_T = +ma$$

$$-13.6 \text{ N} + (-39.2 \text{ N}) + F_T = +8.00 \text{ kg} \times a$$

$$-52.8 \text{ N} + F_T = +8.00 \text{ kg} \times a$$

$$-52.8 \text{ N} + F_T = +8.00 \text{ kg} \times a$$

$$+ F_T - 118 \text{ N} = 12.0 \text{ kg} \times -a$$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$\vec{F}_T + \vec{F}_g = m\vec{a}$$

$$+ F_T - 118 \text{ N} = 12.0 \text{ kg} \times -a$$

$$65.2 \text{ N} = 20.0 \text{ kg} \times a$$

$$a = \frac{65.2 \text{ N}}{20.0 \text{ kg}} = 3.26 \text{ m/s}^2$$

(4 points for method, 1 for final answer) **value: 5**

42.

A)

$$\Delta \bar{d} = \bar{v}_i \Delta t + \frac{1}{2} \bar{a} \Delta t^2$$

$$0 = (20.0 \text{ m/s} \times \sin 37.0^\circ) \Delta t + .5(-9.81 \text{ m/s}^2) \Delta t^2$$

$$12.0 \text{ m/s} \Delta t = 4.91 \text{ m/s}^2 \Delta t^2$$

$$\Delta t = \frac{12.0 \text{ m/s}}{4.91 \text{ m/s}^2} = 2.44 \text{ s}$$

value: 2

B)

$$\Delta \bar{d} = v_x \Delta t = 20.0 \text{ m/s} \times \cos 37.0^\circ \times 2.44 \text{ s} = 39.0 \text{ m}$$

value: 2

C)

$$\Delta \bar{d} = \frac{\dot{v}_f^2 - v_i^2}{2\bar{a}} = \frac{0^2 - (20.0 \text{ m/s} \times \sin 37.0^\circ)^2}{2(-9.81 \text{ m/s}^2)} = +7.38 \text{ m}$$

value: 2

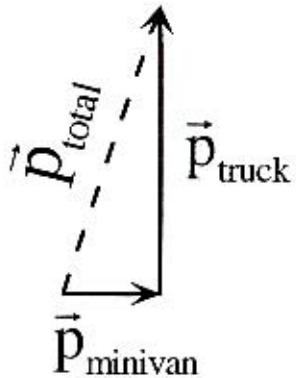
D)

$$\bar{v}_x = 16.0 \text{ m/s}$$

value: 1

$$\bar{v}_y = -\bar{v}_{iy} = -(20.0 \text{ m/s} \times \sin 37.0^\circ) = -12.0 \text{ m/s}$$

43. A)



value: 2

B)

$$\vec{P}_{\text{total}} = \vec{p}_{\text{total}}$$

$$\vec{p}_{\text{total}\ X} = \vec{p}_{\text{total}\ X}$$

$$(m_v + m_t)\vec{v}_x = m_v \vec{v}_{vx} + m_t \vec{v}_{tx}$$

$$(2140 \text{ kg} + 4280 \text{ kg}) v_x = (2140 \text{ kg} \times 20.0 \text{ m/s}) + 0$$

$$v_x = 6.67 \text{ m/s [E]}$$

$$\vec{p}_{\text{total}\ Y} = \vec{p}_{\text{total}\ Y}$$

$$(m_v + m_t)\vec{v}_y = m_v \vec{v}_{vy} + m_t \vec{v}_{ty}$$

$$(2140 \text{ kg} + 4280 \text{ kg}) v_y = 0 + (4280 \text{ kg} \times 30.0 \text{ m/s})$$

$$v_y = 20.0 \text{ m/s [N]}$$

$$v' = \sqrt{(6.67 \text{ m/s})^2 + (20.0 \text{ m/s})^2} = \sqrt{444 \text{ m}^2/\text{s}^2}$$

$$v' = 21.1 \text{ m/s}$$

$$\tan \theta = \frac{v_y}{v_x} = \frac{20.0 \text{ m/s}}{6.67 \text{ m/s}} = 3.00$$

$$\theta = 71.6^\circ$$

$$\vec{v}' = 21.1 \text{ m/s [E } 71.6^\circ \text{ N]}$$

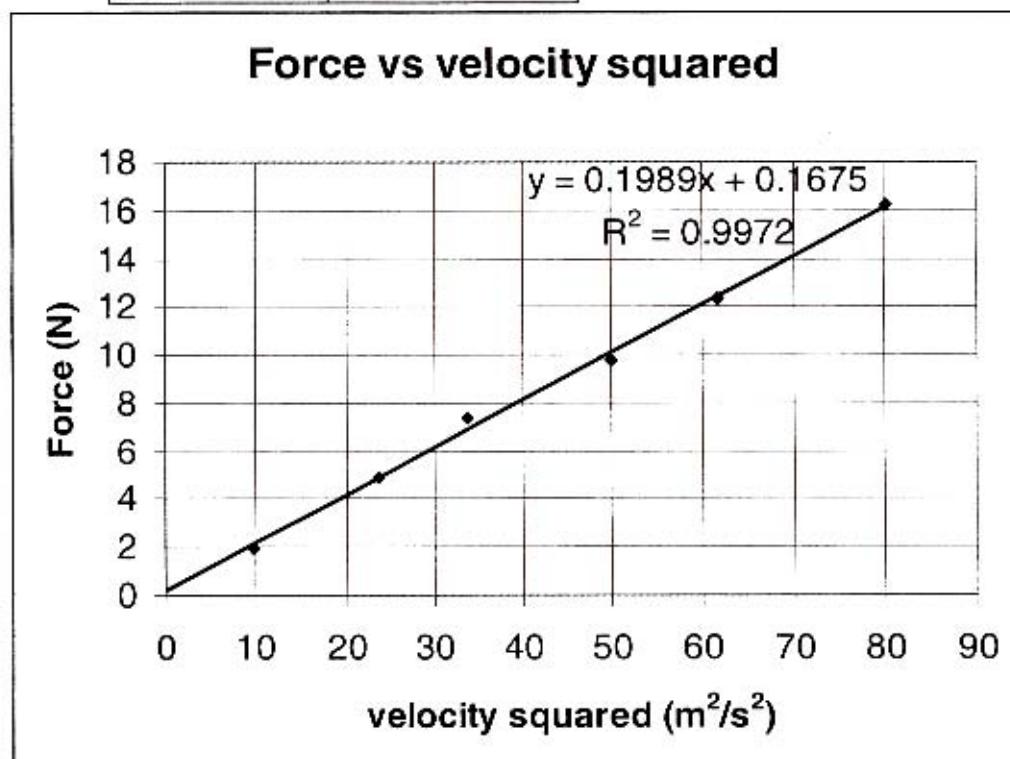
(two points for method, one point for answer) value: 3

44 A) $v = \frac{2\pi}{T} = \frac{2\pi}{1/f} = \frac{2\pi(0.50 \text{ m})}{1/2.25 \text{ Hz}} = 7.07 \text{ m/s}$ and $v^2 = 50.0 \text{ m}^2/\text{s}^2$

value: 1

B)

Force (N)	$v^2 (\text{m}^2/\text{s}^2)$
1.96	9.86
4.91	23.7
7.36	33.8
9.81	50.0
12.3	61.6
16.2	80.1



value: 3

C) Slope = $0.199 \left(\frac{\text{N}}{\text{m}^2/\text{s}^2} \right)$ (must use points on line)

value: 2

D) Since $F_c = mv^2/r$, slope = $\frac{m}{r}$ $0.199 \text{ kg/m} = \frac{m}{r}$ $m = 0.199 \text{ kg/m} \times 0.50 \text{ m}$
 $m = 0.0995 \text{ kg}$ $m = 99.5 \text{ g}$

value: 1

45.

A) At minimum speed the only force contributing to F_c is the weight.

$$F_g = F_c$$

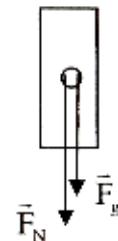
$$mg = \frac{mv^2}{r}$$

$$v^2 = rg$$

$$v = \sqrt{rg} = \sqrt{15.0 \text{ m} \times 9.81 \text{ m/s}^2} = 12.1 \text{ m/s}$$

value: 2

B) F_N (the normal force from the track) can be any size as long as it points downward.



value: 1

46.

$$F_{BC} = \frac{kq_1q_2}{r^2} = \frac{9.00 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} \times (3.60 \times 10^{-5} \text{ C})(5.50 \times 10^{-5} \text{ C})}{(0.0470 \text{ m})^2} = 8.07 \times 10^3 \text{ N}$$

$$\vec{F}_{BC} = 8.07 \times 10^3 \text{ N [E]}$$

value: 1

$$F_{BA} = \frac{kq_1q_2}{r^2} = \frac{9.00 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} \times (3.60 \times 10^{-5} \text{ C})(2.50 \times 10^{-5} \text{ C})}{(0.0320 \text{ m})^2} = 7.91 \times 10^3 \text{ N}$$

$$\vec{F}_{BA} = 7.91 \times 10^3 \text{ N [S]}$$

value: 1

$$F_{net} = \sqrt{(8.07 \times 10^3 \text{ N})^2 + (7.91 \times 10^3 \text{ N})^2} = 1.13 \times 10^4 \text{ N}$$

value: 1

$$\tan \theta = \frac{F_{BA}}{F_{BC}} = \frac{7.91 \times 10^3 \text{ N}}{8.07 \times 10^3 \text{ N}} = 0.981$$

$$\theta = 44.4^\circ$$

value: 1

$$\vec{F}_{net} = 1.13 \times 10^4 \text{ N [E } 44.4^\circ \text{ S]}$$

value: 1

47. A)

$$\Delta E = \frac{-13.6}{2^2} - \left(\frac{-13.6}{3^2}\right) = \frac{-13.6}{4} - \left(\frac{-13.6}{9}\right) = -1.89 \text{ eV}$$

$$E = 1.89 \text{ eV} \times 1.6 \times 10^{-19} \text{ J/eV} = 3.02 \times 10^{-19} \text{ J}$$

(1 for eV, 1 for J, 1 for method)

value: 3

B)

$$E = hf$$

$$f = \frac{E}{h}$$

$$f = \frac{3.02 \times 10^{-19} \text{ J}}{6.626 \times 10^{-34} \text{ Js}} = 4.56 \times 10^{14} \text{ Hz}$$

$$\lambda = \frac{c}{f} = \frac{3.00 \times 10^8 \text{ m/s}}{4.56 \times 10^{14} \text{ Hz}} = 6.57 \times 10^{-7} \text{ m} = 657 \times 10^{-9} \text{ m} = 657 \text{ nm}$$

Yes the wavelength falls within the visible spectrum.

(1 point for method and 1 point for the comparison)

value: 2

48.

A) $^{56}_{26}\text{Fe}$, Iron-56, has the highest binding energy per nucleon. value: 1

B) The slopes of the curve are key to this answer. The steeper the slope the greater the rate at which energy is released as nucleons merge (fusion) or separate (fission). The steeper slope in this curve is on the left side where we have small nuclei which undergo fusion. value: 2

C) mass of nucleus = 4.001506

mass defect = total mass of nucleons – mass of nucleus

mass defect =

$$[(2 \times m_p) + (2 \times m_n)] - 4.001506u$$

$$[(2 \times 1.007276u) + (2 \times 1.008665u)] - 4.001506u$$

$$0.030376u \quad |,007823u \quad \text{on slate.}$$

value: 2

D)

$$m = 0.030376 u \times (1.6605 \times 10^{-27} \text{ kg/u})$$

$$m = 5.0439 \times 10^{-29} \text{ kg}$$

$$E = mc^2 = 5.0439 \times 10^{-29} \text{ kg} \times (3.00 \times 10^8 \text{ m/s})^2$$

$$E = 4.54 \times 10^{-12} \text{ J}$$

value: 1

49.

- A) $^{238}_{92}\text{U} \rightarrow ^{234}_{90}\text{Th} + ^4_2\text{He}$ value: 2
- B) $^{14}_6\text{C} \rightarrow ^{14}_7\text{N} + ^0_{-1}\text{e}$ students may include antineutrino ν value: 2
- C) $^{58}_{29}\text{Cu} \rightarrow ^{58}_{29}\text{Cu} + \gamma$ value: 1

50. A)

$$k_{\text{earth}} = \frac{r^3}{T^2} = \frac{(384.4 \times 10^6 \text{ m})^3}{(2.36 \times 10^6 \text{ s})^2} = 1.02 \times 10^{13} \frac{\text{m}^3}{\text{s}^2}$$

$$k_{\text{pluto}} = \frac{r^3}{T^2} = \frac{(19.7 \times 10^6 \text{ m})^3}{(0.552 \times 10^6 \text{ s})^2} = 2.51 \times 10^{10} \frac{\text{m}^3}{\text{s}^2}$$

value: 2

- B) Teachers are to use discretion about correct answers. Suggestions for evidence are listed here. Evidence that supports teamwork should incorporate Brahe and Kepler or Halley and Newton. Evidence for communication Brahe's recording of data, Newton's Principia. Evidence for questioning Kepler's inability to reconcile circular orbits, Halley's attempt to connect inverse square relationship to elliptical orbits.

value: 3

C)

$$F_g = F_c$$

$$\frac{Gm_{\text{planet}} m_{\text{satellite}}}{r^2} = \frac{m_{\text{satellite}} 4\pi^2 r}{T^2}$$

$$\frac{Gm_{\text{planet}}}{r^2} = \frac{4\pi^2 r}{T^2}$$

$$\frac{r^3}{T^2} = \frac{Gm_{\text{planet}}}{4\pi^2}$$

$$k = \frac{Gm_{\text{planet}}}{4\pi^2}$$

value: 3

D)

$$k = \frac{Gm_{planet}}{4\pi^2} \quad m_{planet} = \frac{4\pi^2 k}{G}$$

$$m_{planet} = \frac{(4\pi^2)(3.20 \times 10^{15} m^3/s^2)}{6.67 \times 10^{-11} Nm^2/kg^2}$$

$$m_{planet} = 1.89 \times 10^{27} kg$$

value: 2