NOVA SCOTIA EXAMINATIONS

PHYSICS 12

JANUARY 2002

MARKING GUIDE

NOVA SCOTIA
Department of Education
Testing and Evaluation

January 2002 Physics
Multiple Choice Answers
Total Value 40

		SCO*			SCO
1.	D	ACP 1	21.	C	215–2
2.	A	ACP 1	22.	A	328–1
3.	D	ACP 1	23.	A	328–1
4.	A	ACP 1	24.	A	328–1
5.	C	ACP 1	25.	D	328–1
6.	B	ACP 1	26.	C	ACP 3
7.	B	ACP 1	27.	B	328–4
8.	C	ACP 1	28.	B	328–4
9.	B	325–12, 13	29.	D	328–5
10.	C	325–12, 13	30.	C	328–6
11.	D	ACP 2	31.	B	328–7
12.	D	326–3	32.	A	ACP 3
13.	D	326–4	33.	B	ACP 3
14.	B	ACP 1; 326–3	34.	D	327–10
15.	A	215–2	35.	C	327–10
16.	B	327–2	36.	C	329–4
17.	B	327–2	37.	C	329–4
18.	A	326–3	38.	C	329–6
19.	A	326–3	39.	A	329–6
20.	C	215–2	40.	C	329–6; 116–6

*Specific Curriculum Outcomes

Nova Scotia Physics 12 Examination
Constructed Response Marking Guide

NOTE: The maximum value for each question is fixed. Value break-downs may need to be changed if the student presents an acceptable alternate solution.

41. Given: $V_m = 14.7$ m/s, 37° from the horizontal
$\Delta d = 26$ m

A) $V_x = V_m \cos\theta = 14.7 \text{ m/s} \cdot 0.80 = 11.8 \text{ m/s}$

$$t_{up} = \frac{0 - V_y}{g} = \frac{0 - V_m \sin\theta}{g} = \frac{-14.7 \text{ m/s} \bullet 0.60}{-9.8 \text{ m/s}^2} = 0.90 \text{ s}$$ **value: 3 for method**

Total time in air = 2 * 0.90 s = 1.80 s

Range = V_x * time in air = 11.8 m/s * 1.80 s = 21.2 m **value: 1**

Distance from goalkeeper = 26.0 m - 21.2 m = 4.8 m **value: 1**

B) time available = time to fall = 0.90 s

$V_{running} = \Delta d/t = 4.8 \text{ m}/0.90 \text{ s} = 5.3 \text{ m/s}$ **value: 2**

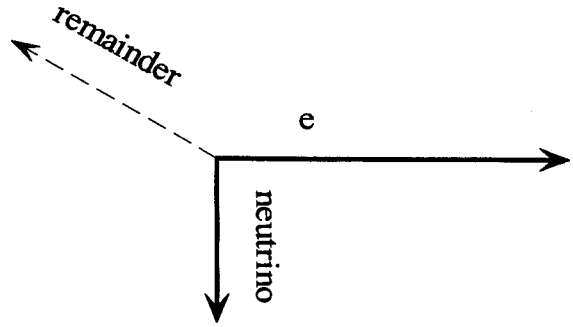
42. Given: $F_c = F_G$ $R = R_J$ + altitude

A) $$\frac{mv^2}{r} = \frac{Gm_1m_2}{r^2} \qquad v = \sqrt{\frac{Gm_J}{r}}$$ **value: 2**

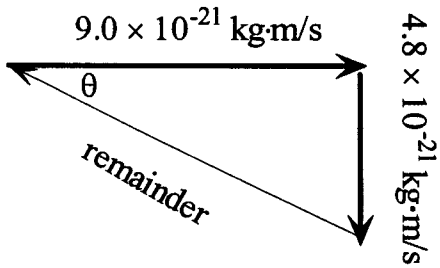
$$v = \sqrt{\frac{6.67\times10^{-11} \text{ Nm}^2/\text{kg}^2 * 1.9\times10^{27} \text{ kg}}{7.68\times10^7 \text{ m}}} = 4.1\times10^4 \text{ m/s}$$ **value: 2**

B) $V = C/T$ $T = C/V = 2\pi R/V = \dfrac{6.28 * 7.68\times10^7 \text{ m}}{4.1 \times 10^4 \text{ m/s}} = 1.2 \times 10^4$ s **value: 2**

43)



p (remainder of nucleus) = $-p_{e+n}$



suitable momentum vector diagram
value: 2

$\tan\theta = 4.8/9 = 0.533 = 28°$ **value: 1**

$$p_{TOTAL} = \sqrt{\left(9.0\times10^{-21}\right)^2 + \left(4.8\times10^{-21}\right)^2}$$

$= 1.0 \times 10^{-20}$ kg-m/s, 28° S of E **method value: 2**

$p_{remainder} = 1.0 \times 10^{-20}$ kg-m/s, 28° N of W

$$v = p/m = \frac{1.0 \times 10^{-20}\ \text{kg-m/s}}{3.6 \times 10^{-25}\ \text{kg}} = 2.8 \times 10^4\ \text{m/s, 28° N of W}$$

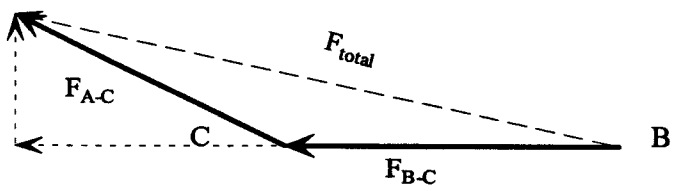
value: 2

44.

$$F_{A-C} = k\frac{Q_A Q_C}{r^2} = \frac{(9.0\times10^9)(4.5\times10^{-5}\,\text{C})(-5.5\times10^{-5}\,\text{C})}{(0.0569\text{m})^2} = 6.9\times10^3\ \text{N}$$

$$F_{B-C} = k\frac{Q_B Q_C}{r^2} = \frac{(9.0\times10^9)(3.6\times10^{-5}\,\text{C})(-5.5\times10^{-5}\,\text{C})}{(0.0470\text{m})^2} = 8.1\times10^3\ \text{N}$$

tan ∠C = y/x =0.0320 m/0.0470 m = 0.681; θ = 34.2° **value: 1**



components for F_{A-C}

$F_x = (6.9\times10^3)(\cos 34.2°) = 5.7\times10^3$ N

$F_y = (6.9\times10^3)(\sin 34.2°) = 3.9\times10^3$ N

value: 2 (method)

$\sum F_x = -13.8\times10^3$ N

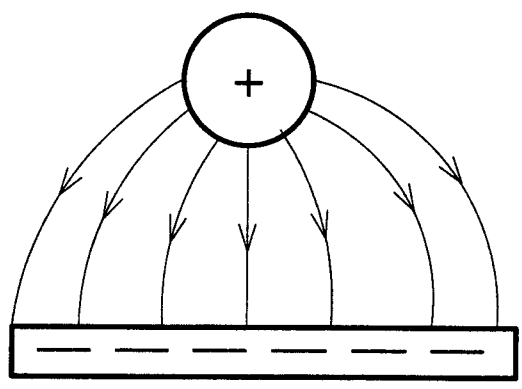
$\sum F_y = 3.9\times10^3$ N

$\tan\theta = F_y/F_x = 3.9\times10^3\ \text{N}/-13.8\times10^3\ \text{N} = 0.283$, θ = 15.7° **value: 2**

$\sum F = \sqrt{F_x^2+F_y^2} = 1.9\times10^4$ N, 15.8° N of W **value: 2**

45.

value: 1 (direction)
1 (general pattern)



46. A) $R_{eq} = \dfrac{1}{\dfrac{1}{R_1 + R_2}} = \dfrac{1}{\dfrac{1}{4} + \dfrac{1}{4}} = 2.0\ \Omega$ **value: 1**

$R_{eq} + R_3 = 6.0\,\Omega$ **value: 1**

$R_T = \dfrac{\dfrac{1}{1}}{R_{eq} + R_4} = 12/5.0 = 2.4\ \Omega$ **value: 1**

B) $I_T = 12\ V/2.4\ \Omega = 5.0\ A$

$I_4 = 12\ V/\ 4.0\ \Omega = 3.0\ A$, then other branch current is 2.0 A

$V_3 = 2.0\ A \times 4.0\ \Omega = 8.0\ V$, then $V_1 = 4.0\ V$ and $I_1 = 1.0\ A$ **value: 3**

C) Since the total resistance of the complex branch is 6.0 Ω, a 2.0 Ω resistor would have to be added to the R_4 branch to make the currents equal. **value: 2**

47.

particle theory	**value: 2**
wave theory	**value: 2**
photoelectric effect	**value: 1**
synthesis	**value: 1**

Organization should be marked out of a **value of 1.**

Mechanics (spelling, grammar) should be marked out of a **value of 1.**

48. A) ${}^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$ **value: 2**

B) ${}^{14}_{6}C \rightarrow {}^{14}_{7}N + e$ **value: 2**

C) The question mark should be replaced by ${}^{58}_{29}Cu$ **value: 1**

49) Case study question

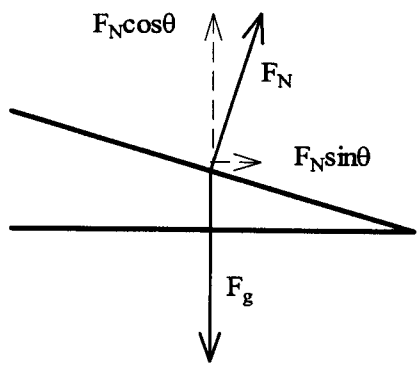
A)

$$v = \frac{120 \text{ km/h}}{3.6 \text{ km/h//m/s}} = 33 \text{ m/s}$$

$$F_c = \frac{mv^2}{r} = \frac{2500\text{kg} \times (33 \text{ m/s})^2}{160 \text{ m}} = 1.7 \times 10^4 \text{ N}$$

value: 2

B)



value: 2

C)

$$\tan\theta = \frac{(33 \text{ m/s})^2}{160 \text{ m} \times 9.8 \text{ m/s}^2} = .695 \qquad \theta = 35°$$

value: 1

D)

$$v = \sqrt{rg\sin\theta} = \sqrt{316 \text{ m} \times 9.8 \text{ m/s}^2 \times \tan 31.0°} = 43.1 \text{ m/s} = 155 \text{ km/h}$$

value: 2

E) 1. $F_N \cos\theta = mg$ $\qquad F_N = \dfrac{mg}{\cos\theta}$

2. $F_N \sin\theta = \dfrac{mv^2}{r}$

substitute equation 1 in equation 2

$$\frac{mg}{\cos\theta} * \sin\theta = \frac{mv^2}{r}$$

$$mg\tan\theta = \frac{mv^2}{r} \qquad \tan\theta = \frac{v^2}{rg}$$

value: 3