NOVA SCOTIA
Department of Education
Testing and Evaluation

NOVA SCOTIA EXAMINATIONS

PHYSICS 12

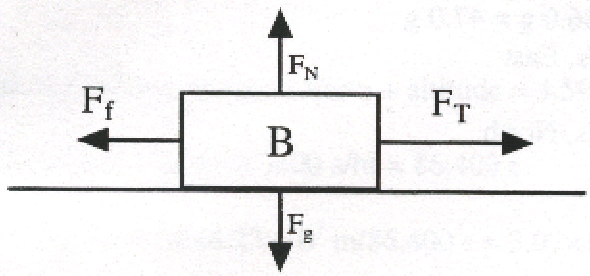
JUNE 2003

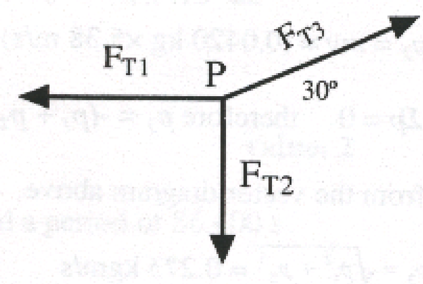
MARKING GUIDE

June 2003 Physics 12
Multiple Choice Answers
Total Value 40

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

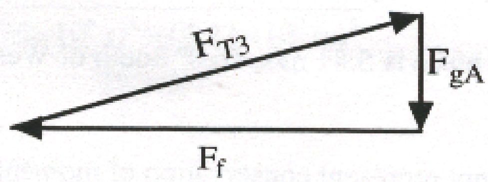
41. A)





value: 1　　　　value: 1

41. B) at point P, $\Sigma F = 0$



As shown in the diagram, $F_{gA} = F_{T2}$　　$F_f = F_{T1}$

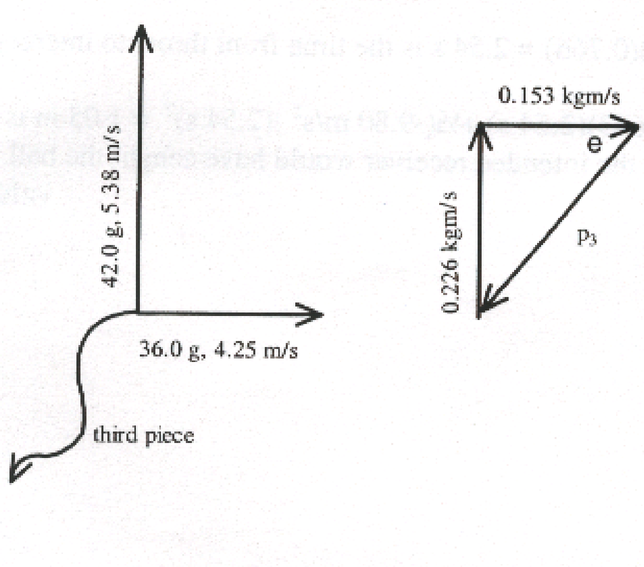
$F_{gA} = mg = 10.5 \text{ kg} \times 9.80 \text{ m/s}^2 = 103 \text{ N}$

$F_f = 103 \text{ N} / \tan 30° = 178 \text{ N}$

$\therefore \mu = F_f / F_N = F_f / F_{gB} = F_f / m_B g = 178 \text{ N} / 72.6 \text{ kg} \times 9.80 \text{ m/s}^2 = 0.250$

The coefficient of friction that would result in no movement must be at least 0.250.　　**value: 3**

42. A)



The mass of the third piece is 125 g - 42.0 g - 36.0 g = 47.0 g
$p_1 = mv$ = (0.0360 kg ×4.25 m/s) = 0.153 kgm/s, East

$p_2 = mv$ = (0.0420 kg ×5.38 m/s) = 0.226 kgm/s, North

$\Sigma p = 0$ therefore $p_3 = -(p_1 + p_2)$

from the vector diagram above,

$p_3 = \sqrt{p_1^2 + p_2^2} = 0.273$ kgm/s

$v = p/m$ = (0.273kgm/s)/(0.0470 kg) = 5.81 m/s

$\tan\theta = p_2/p_1$ = (0.226 kgm/s)/(0.153 kgm/s) = 1.48 = 56.0°

The final velocity of the third piece is 5.81 m/s, 56.0° South of West **value: 4**

42 B) The first diagram does not represent conservation of momentum because the total momentum before collision is approximately zero, while there is a considerable total momentum after collision.
The second diagram represents a glancing collision in which momentum appears to be conserved. A quick check of approximate total momentum before and after the collision shows that they are approximately the same in magnitude and direction. **value: 4**

43\. A) $t = 2v_m\sin\theta/g$ = 2(20.0 m/s)(0.643) / 9.80 m/s^2 = 2.62 s **value: 3**

43\. B) $\Delta d = v_m\cos\theta t$ = (20.0 m/s)(0.766)(2.62 s) = 40.1 m **value: 2**

43\. C) Δd_x = 40.1 m - 1.20 m = 38.9 m is the horizontal distance from the quarterback at intercept

$t = d_x / v_m\cos\theta$ = 38.9 m / (20.0 m/s)(0.766) = 2.54 s is the time from throw to intercept

$\Delta d_y = v_m\sin\theta t + \frac{1}{2}gt^2$ = (20.0 m/s)(0.643)(2.54 s) +½(-9.80 m/s^2)(2.54 s)^2 = 1.05 m is the vertical distance above the height at which the intended receiver would have caught the ball.
value: 4

44. A) radius of orbit = radius of Earth + altitude = 3.59×10^7 m + 6.37×10^6 = 4.23×10^7 m.

time to orbit = 24 hr × 3600 s/hr = 86,400 s

v = 2πR/T = $6.28\times4.23\times10^7$ m/86,400 s = 3.07×10^3 m/s **value: 2**

B) From part A, the satellite has a radius of orbit of 4.23×10^7 m and a period of 86,400 s.

The period of the moon is 27.3 days × 86,400 s/day = 2.36×10^6 s.

from Kepler's law:

$$R_m = \sqrt[3]{\frac{T_m^{\,2}\times R_s^{\,3}}{T_s^{\,2}}} = \sqrt[3]{\frac{(2.36\times10^6 s)^2\times(4.23\times10^7 m)^3}{86{,}400 s^2}} = 3.76\times10^8 \text{ m}$$

value: 3

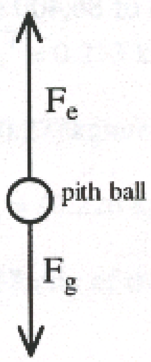
45. Since $\frac{Gm_S m_E}{R_E^{\,2}} = \frac{4\pi^2 m_E R}{T_E^{\,2}}$, then $m_S \alpha \frac{1}{T_E^{\,2}}$

In order for the Sun's mass to change to four (4) times its known value, the value of $1/T^2$ must also increase by a factor of four. Therefore, T^2 must be 1/4 its original value, and T would be ½ its original value. This means the year would be ½ its current length. **value: 3**

46. For a mass hung from a vertically mounted spring, when the position is at maximum extension below rest position, the velocity of the mass is momentarily zero, and the acceleration is at maximum value in the direction of the rest position. **value: 2**

47. A) $\dfrac{1.3\times10^{-6}\text{coulombs}}{1.6\times10^{-19}\text{coulombs per charge}} = 8.1\times10^{12}$ electrons **value: 1**

47. B)



value:1

47. C)

$$F_e = F_g$$

$$\frac{kq_1q_2}{d^2} = mg$$

value: 3

$$d = \sqrt{\frac{kq^2}{mg}} = \sqrt{\frac{(9.0\times10^9\,\text{Nm}^2/\text{C}^2)(1.3\times10^{-6}\,\text{C})^2}{(0.0070\text{kg})(9.8\text{m/s}^2)}} = 0.47\text{m}$$

47. D) $F_e = F_g = mg = 0.007\text{kg}\times9.80\ \text{m/s}^2 = 0.0686\text{N}$ is the electric force of attraction on the lower pith ball needed to lift it.

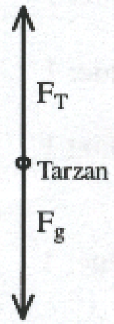
$$F_G = \frac{Gm_1m_2}{r^2} = \frac{(6.67\times10^{-11}\text{Nm}^2/\text{kg}^2)(9.11\times10^{-31}\text{kg})^2}{(0.47\text{m})^2}$$

$$= 1.48\times10^{-14}\,\text{N}$$

This is the gravitational force of attraction between the two electrons.

Clearly, the gravitational force is much less than the electric force, and therefore insignificant, since anything less than 0.006 N is insignificant. **value: 2**

48. A)



value: 1

48. B) The tension in the vine must be the sum of the gravitational force (weight) and the centripetal force.

$$T=\frac{mv^2}{r}+mg=\frac{80.0\text{kg}\times(3.20\text{m/s})^2}{4.00\text{m}}+(80.0\text{kg}\times 9.8\text{m/s}^2)=989\text{N}$$

value: 3

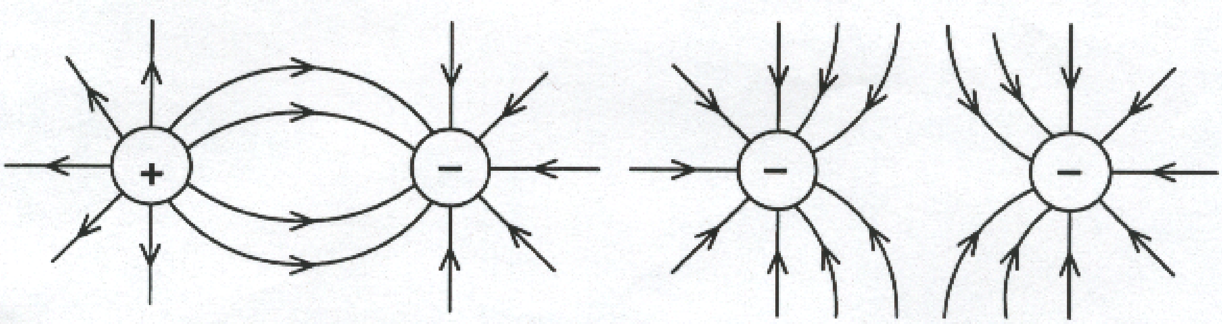
48. C)

$$v=\sqrt{\frac{r(T-mg)}{m}}=\sqrt{\frac{4.00\text{m}(1800.\text{N}-784\text{N})}{80.0\text{kg}}}=7.13\text{m/s}$$

value: 2

49. A) The letters should be in the order: C B A **value: 1**

49. B)



value: 2

49. C) The field between A and B is the same as the field between C and B, indicating opposite poles. This means that A and C are similar poles, and both are opposite to B **value: 2**

50. A) Planck's constant **value: 1**

50. B) (the negative of) the work function **value: 1**

50. C) threshold frequency **value: 1**

50. D) This graph shows ALL kinetic energies of emitted electrons at each frequency, not just maxima. **value: 1**

50. E) 0.9×10^{14} Hz (or 9.0×10^{13} Hz) **value: 2**

50. F) When a line is drawn through the maximum kinetic energies on the graph, a y-intercept of (-) 6×10^{-19} J is indicated. This is closest to the work function for magnesium. **value: 1**

50. G) $v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2 \times 2.05 \times 10^{-18}\,\text{J}}{9.11 \times 10^{-31}\,\text{kg}}} = 2.12 \times 10^{6}\,\text{m/s}$ **value: 2**

50. H) $V = \frac{E}{q} = \frac{(-)2.05 \times 10^{-18}\,\text{J}/(-)1.6 \times 10^{-19}\,\text{J/ev}}{1\,\text{e}} = 12.8\,\text{eV} = 13\,\text{eV}$ **value: 1**