

DTT 2019

Physics HSC Year 11

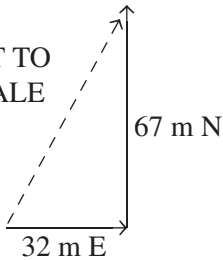
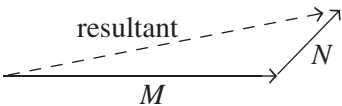
Suggested Solutions and Marking Scheme

Test 2: Module 1 (Kinematics)

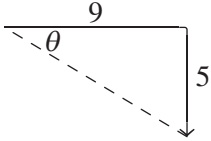
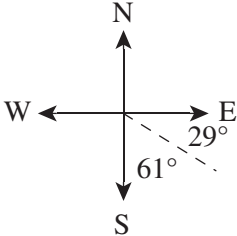
- Motion on a Plane

TOTAL 25 MARKS (45 MINUTES)

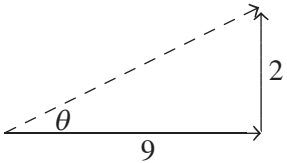
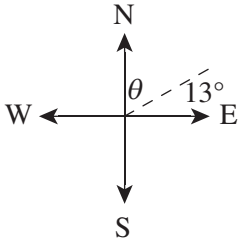
PART A

Answer and explanation	Syllabus outcomes and targeted performance bands
<p>Question 1 C</p> $v_y = v \sin \theta$ $= 60 \times \sin 70^\circ$ $= 56.38 \text{ m s}^{-1}$	PH11-8 Bands 3-4
<p>Question 2 A</p> <p>NOT TO SCALE</p>  $\tan^{-1}\left(\frac{67 \text{ m}}{32 \text{ s}}\right) = \tan^{-1} 2.09375$ $= 64.5^\circ$ $= 90^\circ - 64.5^\circ$ $= 25.5^\circ$	PH11-8 Bands 3-4
<p>Question 3 D</p> 	PH11-8 Bands 1-2

PART B (continued)

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p>b. $\frac{2-6}{20-16} = -1.0 \text{ m s}^{-1}$</p>	<p>PH11-8 Bands 3-4</p> <ul style="list-style-type: none"> Gives the correct answer. <p>AND</p> <ul style="list-style-type: none"> Gives the correct direction. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>Question 10</p> <p>a.</p>  $\tan^{-1}\left(\frac{5}{9}\right)$ $\theta = 29^\circ + 90^\circ$ $= 119^\circ$ <p>OR</p> $90^\circ - 29^\circ = 61^\circ$ <p>From the diagram below, S61°E.</p>  <p>Speed:</p> $c^2 = \sqrt{a^2 + b^2}$ $c = \sqrt{9^2 + 5^2}$ $= 10.2956$ $= 10.3 \text{ m s}^{-1} \text{ (to three significant figures)}$ <p>The final answer is 10.3 m s⁻¹ at S61°E.</p>	<p>PH11-8 Bands 4-5</p> <ul style="list-style-type: none"> Gives the correct answer in m s⁻¹. <p>AND</p> <ul style="list-style-type: none"> Gives the correct angle. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>b. $\frac{180 \text{ m}}{9 \text{ s}} = 20 \text{ seconds}$</p> $20 \text{ seconds} \times 2 \text{ m s}^{-1} = 40 \text{ m downstream}$	<p>PH11-8 Bands 4-5</p> <ul style="list-style-type: none"> Determines time as 20 s. <p>AND</p> <ul style="list-style-type: none"> Gives correct answer as 40 m downstream. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1

PART B (continued)

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p>c.</p>  $\tan^{-1}\left(\frac{2}{9}\right) = 12.53^\circ \text{ or } 13^\circ$  <p>$90 - 13 = 77$ $\therefore \text{N}77^\circ\text{E}$</p>	<p>PH11-8 Bands 3-4</p> <ul style="list-style-type: none"> • Correctly draws vector diagram. <p>AND</p> <ul style="list-style-type: none"> • Demonstrates working. <p>AND</p> <ul style="list-style-type: none"> • Correctly determines angle. 3 <hr/> <ul style="list-style-type: none"> • Any TWO of the above points. 2 <hr/> <ul style="list-style-type: none"> • Any ONE of the above points. 1

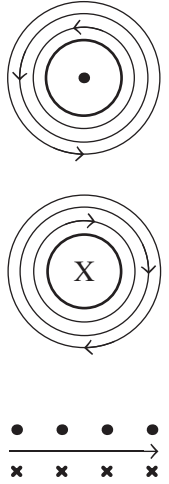
PART B (continued)

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
b. $m = \frac{F}{a}$ $= \frac{18\,000\text{ N}}{1.25\text{ m s}^{-2}}$ $= 14\,400\text{ kg}$	PH11-9 Bands 3-4 • Gives the correct solution. 1
Question 9 a. $v = u + at$ $a = \frac{v - u}{t}$ $= \frac{9.25 - 4.25}{205}$ $= 0.25\text{ m s}^{-2}$	PH11-8, 9 Bands 3-4 • Gives the correct equation to determine acceleration. AND • Gives the correct solution. 2 <hr/> • Any ONE of the above points. 1
b. $K_e = \frac{1}{2}m(v^2 - u^2)$ $= \frac{1}{2} \times 16 \times (9.25^2 - 4.25^2)$ $= 540\text{ J}$	PH11-9 Bands 4-5 • Gives the correct equation to determine K_e . AND • Gives the correct solution. 2 <hr/> • Any ONE of the above points. 1
c. $P = \frac{E}{T}$ $= \frac{540\text{ J}}{20\text{ s}}$ $= 27\text{ W}$	PH11-9 Bands 2-3 • Gives the correct equation to determine P . AND • Gives the correct solution. 2 <hr/> • Any ONE of the above points. 1
Question 10 a. $U = mgh$ $= 1.36\text{ kg} \times 9.8\text{ m s}^{-2} \times 252\text{ m}$ $= 3359\text{ J}$	PH11-9 Bands 3-4 • Gives the correct solution. 1
b. $U = mgh$ $h = \frac{U}{mg}$ $= \frac{136\text{ J}}{0.583 \times 9.8\text{ m s}^{-2}}$ $= 23.8\text{ m}$	PH11-9 Bands 4-5 • Gives the correct equation to determine h . AND • Gives the correct solution. 2 <hr/> • Any ONE of the above points. 1

PART B – 20 MARKS

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p>Question 6</p> <p>a. $a = \frac{F}{m}$</p> $= \frac{6128}{(134 + 76)}$ $= 29.6 \text{ m s}^{-2}$	<p>PH11-9 Bands 2-3</p> <ul style="list-style-type: none"> Gives the correct equation to determine acceleration. <p>AND</p> <ul style="list-style-type: none"> Gives the correct solution 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>b. net force on block $P = 134 \times 29.6 \text{ m s}^{-2} = 3966.4 \text{ N}$ net force on block $Q = 76 \times 29.6 \text{ m s}^{-2} = 2249.6 \text{ N}$</p>	<p>PH11-9 Bands 2-3</p> <ul style="list-style-type: none"> Calculates the correct net force on block P. <p>AND</p> <ul style="list-style-type: none"> Calculates the correct net force on block Q. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>c. Step 1:</p> $a = \frac{F_{\text{net}}}{M_{\text{total}}}$ $= \frac{6218 \text{ N}}{(156 + 76)}$ $= 26.8 \text{ m s}^{-2}$ <p>To two significant figures, 27 m s^{-2}.</p> <p>Step 2:</p> $\text{tension} = m \times a$ $= 156 \times 26.8$ $= 4180.8 \text{ N}$ <p>To two significant figures, 4200 N.</p>	<p>PH11-9 Bands 5-6</p> <ul style="list-style-type: none"> Demonstrates the correct working to determine acceleration. <p>AND</p> <ul style="list-style-type: none"> Calculates the correct acceleration. <p>AND</p> <ul style="list-style-type: none"> Calculates the correct tension. 3 <hr/> <ul style="list-style-type: none"> Any TWO of the above points. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>Question 7</p> $m_1 u_1 + m_2 u_2 = (m_1 + m_2)v$ $44 \times 0 + 0.25 \times 9 = (44 + 0.25)v$ $0 + 2.25 = 44.25v$ $\frac{2.25}{44.25} = v$ $v = 0.051 \text{ m s}^{-1} \text{ East}$	<p>PH11-9 Bands 4-5</p> <ul style="list-style-type: none"> Gives the correct equation. <p>AND</p> <ul style="list-style-type: none"> Correctly manipulates the equation. <p>AND</p> <ul style="list-style-type: none"> Calculates the correct velocity. 3 <hr/> <ul style="list-style-type: none"> Any TWO of the above points. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1

PART B (continued)

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p>Question 8</p> 	<p>PH11–12 Bands 3–4</p> <ul style="list-style-type: none"> Annotates the first diagram with an anticlockwise representation of magnetic field lines. <p>AND</p> <ul style="list-style-type: none"> Annotates the second diagram with an X in the middle of the circle to represent current. <p>AND</p> <ul style="list-style-type: none"> Annotates the third diagram with an arrow pointing to the right to represent current. 3 <hr/> <ul style="list-style-type: none"> Any TWO of the above points. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>Question 9</p> <p><i>For example, any one of:</i></p> <ul style="list-style-type: none"> placing the ferromagnetic material in a magnetic field stroking a magnet over the ferromagnetic material repeatedly in the same direction 	<p>PH11–12 Bands 2–3</p> <ul style="list-style-type: none"> Identifies ONE way that a ferromagnetic material can be magnetised. 1
<p>Question 10</p> $B = \frac{M_0 NI}{L}$ $= \frac{4 \times \pi \times 10^{-7} \times 450 \times 2.5}{15 \times 10^{-3}}$ $= 0.094 \text{ m}$	<p>PH11–12 Bands 5–6</p> <p>AND</p> <ul style="list-style-type: none"> Gives the correct solution in m. <p>AND</p> <ul style="list-style-type: none"> Gives the correct equation. 2 <hr/> <ul style="list-style-type: none"> Any ONE of the above points. 1
<p>Question 11</p> <p><i>For example, any two of:</i></p> <ul style="list-style-type: none"> increasing the number of turns increasing the amount of current wrapping the wire around a core (nail or metal) 	<p>PH11–12 Bands 2–3</p> <ul style="list-style-type: none"> Identifies TWO appropriate methods. 2 <hr/> <ul style="list-style-type: none"> Identifies ONE appropriate method. 1