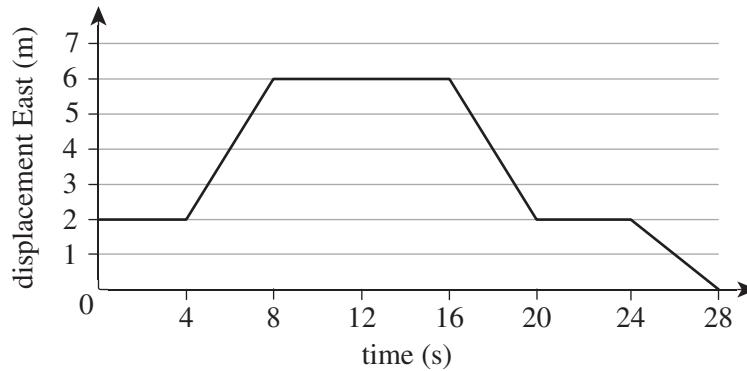


**Question 9** (5 marks)

A group of Physics students graphed the movement of a toy train along a track. The graph is shown below.



- a. Complete the table using the data presented in the graph. 3 marks

<b>Time (s)</b>	8	14	28
<b>Displacement East (m)</b>			

- b. Calculate the velocity of the train after 18 s. Give your answer correct to two significant figures. 2 marks

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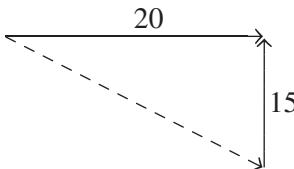


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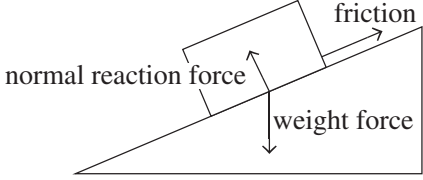


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**PART B – 20 MARKS**

Sample answer	Syllabus outcomes, targeted performance bands and marking guide								
<b>Question 6</b> <b>a.</b> 90 km h <sup>-1</sup> converted into m s <sup>-1</sup> is 25 m s <sup>-1</sup> . 40 km h <sup>-1</sup> converted into m s <sup>-1</sup> is 11.1 m s <sup>-1</sup> . Therefore the velocity of the cyclist relative to the truck is -13.9 m s <sup>-1</sup> .	PH11-8 Bands 3-4 • Gives the correct solution. 1								
<b>b.</b> Using the conversions in <b>part a.</b> , the velocity of the truck relative to the cyclist will be +13.9 m s <sup>-1</sup> .	PH11-8 Bands 3-4 • Gives the correct solution. 1								
<b>Question 7</b>  Use the Pythagoras theorem to find angle $\tan^{-1}\left(\frac{15}{20}\right)$ . resultant = $\sqrt{20^2 + 15^2}$ = 25 m s <sup>-1</sup> at S53°E	PH11-8 Bands 4-5 • Gives the correct answer in m s <sup>-1</sup> . AND • Gives the correct angle. 2 <hr/> • Any ONE of the above points. 1								
<b>Question 8</b> <b>a.</b> vector A + vector C – vector D 30 m right + (-19 m left) – 13 m right = -2 m right <b>OR</b> 2 m left	PH11-8 Bands 1-2 • Gives the correct solution. 1								
<b>b.</b> vector B – vector C + vector D 30 m right – 19 m left + 13 m right = 18 m right	PH11-8 Bands 1-2 • Gives the correct solution. 1								
<b>c.</b> vector A + vector B + vector C 30 m right + (-14 m left) + (-19 m left) = -3 m right <b>OR</b> 3 m left	PH11-8 Bands 1-2 • Gives the correct solution. 1								
<b>d.</b> vector D – vector C – vector B 30 m right – (-19 m left) – (-14 m left) = 46 m right	PH11-8 Bands 1-2 • Gives the correct solution. 1								
<b>Question 9</b> <b>a.</b> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Time (s)</th> <th>8</th> <th>14</th> <th>28</th> </tr> </thead> <tbody> <tr> <th>Displacement (m East)</th> <td>6</td> <td>6</td> <td>0</td> </tr> </tbody> </table>	Time (s)	8	14	28	Displacement (m East)	6	6	0	PH11-8 Bands 2-3 • Correctly completes all <b>THREE</b> table entries. 3 <hr/> • Correctly completes <b>TWO</b> table entries. 2 <hr/> • Correctly completes <b>ONE</b> table entry. 1
Time (s)	8	14	28						
Displacement (m East)	6	6	0						

**PART B – 20 MARKS**

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p><b>Question 6</b></p> 	<p>PH11-9 Bands 3-4</p> <ul style="list-style-type: none"> <li>Includes all THREE arrows.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Labels all THREE arrows correctly. 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Includes some arrows AND labels. 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Includes only arrows OR labels. 1</li> </ul>
<p><b>Question 7</b></p> <p>a. <math>F = mg\sin\theta</math>  <math>= 45 \text{ kg} \times 9.8 \text{ m s}^{-2} \times \sin 17^\circ</math>  <math>= 129 \text{ N}</math></p>	<p>PH11-9 Bands 3-4</p> <ul style="list-style-type: none"> <li>Gives the correct equation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Gives the correct answer. 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any ONE of the above points. 1</li> </ul>
<p>b. <math>F = mg\cos\theta</math>  <math>= 45 \text{ kg} \times 9.8 \text{ m s}^{-2} \times \cos 17^\circ</math>  <math>= 422 \text{ N}</math></p>	<p>PH11-9 Bands 3-4</p> <ul style="list-style-type: none"> <li>Gives the correct equation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Gives the correct answer. 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any ONE of the above points. 1</li> </ul>
<p>c. The net force acting on the block will be the same as <b>part a.</b>, which is 129 N.</p>	<p>PH11-9 Bands 3-4</p> <ul style="list-style-type: none"> <li>Gives the correct solution. 1</li> </ul>
<p>d. <math>F = ma</math>  <math>a = \frac{F}{m}</math>  <math>= \frac{129 \text{ N}}{45 \text{ kg}}</math>  <math>= 2.87 \text{ m s}^{-2}</math></p>	<p>PH11-9 Bands 2-3</p> <ul style="list-style-type: none"> <li>Gives the correct solution. 1</li> </ul>
<p><b>Question 8</b></p> <p>a. <math>a = \frac{F}{m}</math>  <math>= \frac{115 \text{ N}}{125 \text{ kg}}</math>  <math>= 0.92 \text{ m s}^{-2}</math></p>	<p>PH11-9 Bands 2-3</p> <ul style="list-style-type: none"> <li>Gives the correct solution. 1</li> </ul>

**Question 2**

A 45 cm long solenoid has 3750 turns of wire. The current passing through it is 1.67 A.

What is the magnetic field produced by the solenoid?

- A. 0.0001 T
- B. 0.0175 T
- C. 0.1749 T
- D. 3.8863 T

**Question 3**

Which row of the table correctly gives the magnetic forces when two magnets are placed with like poles facing each other and with unlike poles facing each other.

	Like poles facing each other	Unlike poles facing each other
A.	repel	repel
B.	attract	attract
C.	repel	attract
D.	attract	repel

**Question 4**

How is greater strength magnetic field represented in a magnetic field diagram?

- A. a larger drawing of the magnet
- B. larger arrows on the field lines
- C. different colours used to represent the field lines so it is easier to interpret
- D. field lines that are closer together

**Question 5**

Which one of the following is the most correct definition of 'magnetic domain'?

- A. a region within a magnetic material in which its magnetisation is uniform
- B. a region within a non-magnetic material in which its magnetisation is uniform
- C. a region within a magnetic material in which its magnetisation is non-uniform
- D. a region where field lines are uniform from North to South

**Question 10** (2 marks)

A solenoid consists of 450 windings and has a current of 2.5 A supplied to its windings. The strength of the magnetic field at the centre of the solenoid is 15 mT.

How long is this solenoid? Give your answer in m correct to two significant figures.

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**Question 11** (2 marks)

Identify TWO methods of increasing the magnetic field strength of an electromagnet.

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**END OF QUESTION AND ANSWER BOOKLET**

**PART B (continued)**

Sample answer	Syllabus outcomes, targeted performance bands and marking guide
<p><b>Question 10</b> Determine the decay constant, <math>\lambda</math>.</p> $\lambda = \frac{\ln(2)}{t_{\frac{1}{2}}}$ $= \frac{\ln(2)}{5730}$ $= 1.21 \times 10^{-4} \text{ year}^{-1}$ <p>Observe that if the decay rate is <math>0.25 \text{ Bq g}^{-1}</math>, when there was 10 g of carbon-14, the activity was <math>10 \times 0.25 = 2.5 \text{ Bq}</math>. We can now use the equation <math>N_t = N_0 e^{-\lambda t}</math>. If the activity is now 2.11 Bq, then:</p> $2.11 = 2.5 e^{-1.21 \times 10^{-4} t}$ <p>OR</p> $\ln\left(\frac{2.11}{2.5}\right) = -1.21 \times 10^{-4} t$ $t = 1402 \text{ years}$ <p><i>Note: Marks can be awarded for high-level responses in which errors are carried forward.</i></p>	<p>PH12–15 Bands 4–6</p> <ul style="list-style-type: none"> <li>Attempts to use the decay constant equation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Correctly calculates the decay constant.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Attempts to use <math>N_t = N_0 e^{-\lambda t}</math>.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Correctly calculates the activity.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Gives the correct solution. 5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any FOUR of the above points. 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any THREE of the above points. 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any TWO of the above points. 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Any ONE of the above points. 1</li> </ul>