



**EDUCATIONAL QUALITY AND
ASSESSMENT PROGRAMME**



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***Scoring
Rubric
2021***

**South Pacific
Form Seven
Certificate**

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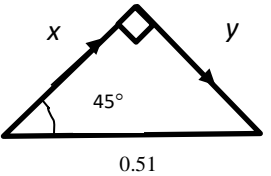
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STRAND 1: Demonstrate understanding, by explanation and solving problems, of the physical phenomena, concepts, principles and relationships involved in mechanics.

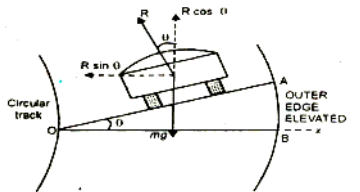
STRAND 1: MECHANICS

1.1 TRANSLATIONAL MOTION

Item #	Skill Band	Evidence	Student Response Level					
			Unistructural	Multistructural	Relational	Extended Abstract	Weak	
1.1a	1	A	Correct answer					Incorrect answer
1.1b	1	Momentum is directly related (directly proportional) to the velocity of the object.	Correct answer					Incorrect answer
1.1c	2	$I = Ft = m\Delta v$(i) $= m(v_f - v_i)$(ii) $= 0.65(15 - 10)$(iii) $I = 0.65 \times 5$(iv) $I = 3.25 \text{ Ns}$	Step (i) OR Step (ii) OR Step (iii) OR Getting 5 in Step (iv)	Correct final answer Or slip in calculation				Incorrect answer
1.1d	2	In any collision, momentum is conserved. Thus total momentum before equals total momentum after. Assuming it is a perfectly elastic collision $KE_{before} = KE_{after}$ After collision, the smaller mass, Trolley B speeds off forward while the massive, Trolley A moves forward but at a speed slower than its initial speed.	Mentions any fact about elastic collision. i.e. Momentum is conserved. Kinetic energy is conserved.	Mentions that Trolley A slows down in the forward direction. Trolley B speeds up in the forward direction.				Invalid facts.

Item #	Skill Band	Evidence	Student Response Level					
			Unistructural	Multistructural	Relational	Extended Abstract	Weak	
1.1e	1	Inelastic collision is a collision where only momentum is conserved. OR Collision where kinetic energy is not conserved.	Correct definition				Incorrect definition.	
1.1f	3	$p_{initial} = p_{final}$ $(0.17 \times \vec{3}) + (0.16 \times 0)$ $= (0.17 \times v_c) + (0.16 \times v_e)$ $\vec{0.51} + 0 = x + y$  <p>Since it is a 45 45 90 triangle, it is an isosceles triangle. Therefore $x=y$ which means</p> $x^2 + y^2 = (0.51)^2$ $2x^2 = (0.51)^2$ $x = 0.36 = y$	<p>Any expression of the Law of conservation of momentum</p> <p>OR</p> <p>Mention of 0.51 kgms^{-1} (the total momentum before collision)</p>	<p>Mentions any two of these facts independently:</p> <p>-Use of right triangle</p> <p>-Use of Pythagoras</p> <p>-Getting 0.36 kgms^{-1}</p>	$0.36 = 0.17v_c$ $\therefore v_c = 2.11 \text{ ms}^{-1}$ <p>OR</p> $0.36 = 0.16v_e$ $\therefore v_e = 2.25 \text{ ms}^{-1}$ <p>Correct answer</p> <p>OR correct working and 'slip' in calculation</p>		Incorrect answer	
		$\Rightarrow 0.36 = 0.17v_c$ $\therefore v_c = 2.11 \text{ ms}^{-1}$	$\Rightarrow 0.36 = 0.16v_e$ $\therefore v_e = 2.25 \text{ ms}^{-1}$					

1.2 : CIRCULAR AND ROTATIONAL MOTION

1.2a	1	The tension force of the string	Correct statement.				Incorrect statement
1.2b	2	 <p>https://www.sarthaks.com/571760/obtain-expression-maximum-speed-with-which-vehicle-safely-negotiate-curved-banked-angle</p>	One correct label	Two or more correct labels			Incorrect labelling

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
1.2c	2	$mg = F_R \cos \theta \dots\dots\dots(i)$ $1200 \times 10 = F_R \cos 25^\circ$ $F_R = \frac{12000}{\cos 25}$ $F_R = 13240.54 \text{ N} \dots\dots\dots(ii)$ $F_c = F_R \sin \theta = \frac{mv^2}{r} \dots\dots\dots(iii)$ $13241 \sin 25 = \frac{1200v^2}{20}$ $\Rightarrow v = 9.66 \text{ ms}^{-1} \dots\dots\dots(iv)$	Mention of (i) or (iii) without any calculation Or Getting (ii)	Correct answer OR correct working and 'slip' in calculation			Incorrect answer
1.2d	2	$PE_{lost} = KE_{gained} \dots\dots\dots(i)$ $= KE_{linear} + KE_{rotational} \dots\dots(ii)$ $= \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 \dots\dots\dots(iii)$ $= \left(\frac{1}{2} \times 8 \times 10.54^2\right)$ $\quad + \left(\frac{1}{2} \times 1.02 \times 26.4^2\right)$ $E_{Total} = 444.37 + 355.45 \dots\dots\dots(iv)$ $E_{Total} = 799.82 \text{ J} \dots\dots\dots(v)$	Mention of (i) or (ii) or (iii) or one of the two values in (iv) Without any calculation	Correct answer OR correct working and 'slip' in calculation			Incorrect answer
1.2e	2	$\omega = \frac{v}{r} \dots\dots\dots(i)$ $= \frac{5}{8.6}$ $\omega = 0.58 \text{ rads}^{-1} \dots\dots\dots(ii)$	Identified correct formula (i)	Correct answer (ii) OR correct working and 'slip' in calculation			Incorrect answer
1.2f	3	A solid sphere has the smallest rotational inertia (I) compared to the other two. All masses lose gravitational PE and gain rotational KE as they roll downhill. In a solid sphere, more mass close to the centre, thus has the smallest rotational inertia A solid cylinder has its mass evenly spread out thus has medium rotational inertia. In a hollow	Mentions that a solid sphere has the smallest rotational inertia compared to the other two OR	Solid sphere : ↓ Rot inertia, ↑ Rot KE, ↑ acc, ↑ velocity Hollow cylinder : ↑ Rot inertia, ↓ linear KE, ↓ acc, ↓ velocity	Solid sphere : ↓ Rot inertia, ↑ Rot KE, ↑ acc, ↑ velocity Hollow cylinder : ↑ Rot inertia, ↓ linear KE, ↓ acc, ↓ velocity		Invalid conceptual understanding.

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		cylinder, all of its mass is far from the centre thus has the largest rotational inertia. The object with a smaller I gain a smaller value of rotational KE which is directly proportion to an increase in linear KE which means larger acceleration of rolling, increase speed of rolling.	Hollow cylinder has the largest rotational inertia	Mentions two or more facts above independently without any relationship	Mentions two or more facts above, showing clearly the relationship between rotational inertia, KE, acceleration & velocity.		

1.3: SIMPLE HARMONIC MOTION (SHM)

1.3a	1	The displacement in a SHM is given by $y = A \sin \omega t$	Correct answer				Incorrect answer
1.3b	1	The SHM equation for acceleration is $a = -\omega^2 y$	Correct answer				Incorrect answer
1.3c	1	Oscillation where the amplitude decreases over time and the motion ultimately ceases	Correct definition				Incorrect definition
1.3d	2	$\omega = \sqrt{\frac{k}{m}} \dots \dots \dots (i)$ $= \sqrt{\frac{10}{1}}$ $\omega = 3.16 \text{ rads}^{-1} \dots \dots \dots (ii)$	Step (i)	Correct answer (ii) OR correct working and 'slip' in calculation			Incorrect answer
1.3e	3	$F = mg = kx \dots (i)$ $\Rightarrow (10 \times 10^{-3})(10) = k(4.1 \times 10^{-2}) \dots (ii)$ $0.1 = 0.041k$ $k = 2.44 \text{ Nm}^{-1} \dots (iii)$ $T = 2\pi \sqrt{\frac{m}{k}} \dots \dots \dots (iv)$ $= 2\pi \sqrt{\frac{25 \times 10^{-3}}{2.44}} \dots \dots \dots (v)$ $T = 0.64 \text{ s} \dots \dots \dots (vi)$	Mentions any one of these (i) or (iv) OR Any conversion in (ii) or (v)	Gets the value of k OR correct working and 'slip' in calculation	Correct answer (vi) OR correct working and 'slip' in calculation		Incorrect answer

STRAND 2: Demonstrate understanding, by explanation and solving problems, of the physical phenomena, concepts, principles and relationships involved in waves.

STRAND 2: WAVES

2.1: WAVE PROPERTIES

Item #	Skill Band	Evidence	Student Response Level					
			Unistructural	Multistructural	Relational	Extended Abstract	Weak	
2.1a	1	A	Correct answer					Incorrect answer
2.1b	1	Diffraction is the bending of a wave as it passes through a gap or around the edge of a barrier. It happens to water, sound and electromagnetic waves. Diffraction is most noticeable when the gap/barrier is about the same size as the wavelength of the wave.	Correct definition OR Any one correct idea.					Incorrect definition
2.1c	2	Wavelength, frequency, medium and temperature	Gives one correct variable	Gives two or more variables				Incorrect answer
2.1d	3	$n\lambda = \frac{dx}{L}$(i) $x = \frac{n\lambda L}{d}$(ii) $x = \frac{3 \times (671 \times 10^{-9}) \times 2}{(0.10 \times 10^{-2})}$(iii) $x = 4.03 \times 10^{-3}$ m OR 4 mm.....(iv)	Step (i) Or (ii)	Step (iii) Or Conversions or any two n=3 $\lambda = 671 \times 10^{-9}$ d = 0.10×10^{-2} m	Correct answer (iv) OR correct working and 'slip' in calculation			Incorrect answer

2.2 SOUND WAVES

2.2a	1	A standing wave is formed by two travelling waves with the same frequency, wavelength and amplitude travelling in opposite directions.	Correct definition					Incorrect definition
2.2b	1	Resonant frequency occurs when the driving frequency of a system equals its natural frequency.	Correct definition or anything to that effect					Incorrect definition

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		Frequency at which a system oscillates at its maximum amplitude.					
2.2c	4	Both the wavelength and speed of sound changes with a change in medium. Frequency depends on the source of sound, not the medium of propagation. Sound travels faster in a dense medium than in a less dense medium. Speed of sound depends on elasticity and density of medium. The greater the elasticity, the lower the density, the faster the sound travels. Increase in temperature (at constant pressure) causes air to expand, become less dense thus speed of sound increases. Pitch and loudness have no effect on velocity.	Mentions one fact.	Mentions two or more facts independently.	Relates speed to any change in medium.	Makes connections (relations) with some example. Speed of sound \propto density of medium Fastest in solid (5300 in steel), than liquid (1500 in water) and slowest in gas (330in air)	Invalid conceptual understanding.
2.2d	1	Doppler Effect is the change in observed frequency caused by relative movement between a source of waves and an observer.	Correct definition				Incorrect definition

STRAND 3: Demonstrate understanding, by explanation and solving problems, of the physical phenomena, concepts, principles and relationships involved in electricity and electromagnetism.

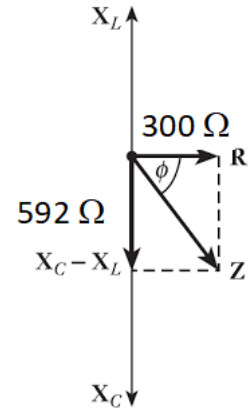
STRAND 3: ELECTRICITY AND ELECTROMAGNETISM

3.1 DC CIRCUITS AND CAPACITANCE

Item #	Skill Band	Evidence	Student Response Level					
			Unistructural	Multistructural	Relational	Extended Abstract	Weak	
3.1a	1	Capacitance is the value of a capacitor and is measured in Farads (F)	Correct definition					Correct definition
3.1b	1	The total current entering a junction equals the total current leaving a junction.	Correct statement					Incorrect statement
3.1c	2	$C_T = C_1 + C_2 + C_3 + \dots \dots \dots (i)$ $= (10 \times 10^{-6}) + (2.5 \times 10^{-6})$ $C_T = 1.25 \times 10^{-5}$ OR $12.5\mu\text{F}$	Step 1 Conversion: 10×10^{-6} OR 2.5×10^{-6}	Correct working and answer. OR correct working but minor 'slip' in calculation.				Incorrect answer

3.2: ELECTROMAGNETIC INDUCTION

3.2a	1	Magnetic flux is the measurement of total magnetic field passing through a given area. A quantity equal to the product of magnetic field strength and area perpendicular to the field.	Correct definition or anything to that effect					Correct definition
3.2b	3	A transformer is a device used to change the voltage in an AC circuit from one value to another. There are two types of transformers; step-up and step-down transformer. Transformers consist of a primary coil, a laminated soft iron core and a secondary coil. It works on the principle of magnetic induction. When voltage is introduced to the primary coil (input), it magnetises the iron core, in turn induces voltage into the secondary coil (output). The amount of voltage in the two coils is directly proportional to the number of	Mentions one fact.	Mentions two or more facts independently.	Includes the relationship that the number of turns is directly proportional to the voltage. i.e. the more the turns, the greater the voltage			Invalid conceptual understanding

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		turns in each coil. If the secondary coil has more number of turns than the primary coil, then it is a step-up transformer. If the number of turns in the secondary coil is less than that of the primary coil, then it is a step-down transformer.					
3.3a	3	$X_L = 2\pi fL$ $= 2\pi(60)(0.50)$ $X_L = 188\Omega \dots\dots\dots(i)$ $X_C = \frac{1}{2\pi fC}$ $= \frac{1}{2\pi(60)(3.4 \times 10^{-6})}$ $X_C = 780\Omega \dots\dots\dots(ii)$ <p>Since $X_C > X_L$, the circuit is capacitive.</p>  <p>The phasor angle, ϕ, is given by:</p> $\tan \phi = \frac{592}{300} \dots\dots\dots(iii)$	<p>Mentions one of these:</p> <p>(i) OR (ii) OR</p> <p>the use of SOHCAHTOA</p>	<p>Mentions two or more of these:</p> <p>(i) OR (ii) OR</p> <p>the use of SOHCAHTOA</p>	<p>Mentions that because</p> <p>$X_C > X_L$, this is a capacitive circuit.</p> <p>Full calculation arriving to the value of ϕ</p>	Invalid conceptual understanding	

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		$\theta = \tan^{-1} \frac{592}{300}$ $\theta = 63.1^\circ$					

STRAND 4: Demonstrate understanding, by explanation and solving problems, of the physical phenomena, concepts, principles and relationships involved in atomic and nuclear physics.

STRAND 4: ATOMIC AND NUCLEAR PHYSICS

4.1: ATOMIC PHYSICS

Item #	Skill Band	Evidence	Student Response Level					
			Unistructural	Multistructural	Relational	Extended Abstract	Weak	
4.1a	1	13.6eV	Correct answer					Correct answer
4.1b	1	Ultra-violet	Correct answer					Incorrect answer
4.1c	2	$\lambda = \frac{c}{f}$(i) $= \frac{3 \times 10^8}{4.57 \times 10^{14}}$(ii) $\lambda = 6.56 \times 10^{-7} \text{m}$(iii)	Step (i)	Correct working and answer. OR 'slip' in calculation				Incorrect answer
4.1d	4	<p>Postulates of Bohr's theory</p> <ul style="list-style-type: none"> -electrons in an atom exist in stable, circular orbits -electrons in stable orbits do not emit radiation -electrons absorb or emit specific quanta of energy when they move from one stable energy level to another <p>Limitations of Bohr's theory</p> <ul style="list-style-type: none"> -the model predicted spectral lines accurately for hydrogen -the model was not accurate for larger atoms -it worked for atoms with one valence electron better than it worked for atoms with more than one valence electron 	Mentions any one postulate or any one limitation	Mentions two or more correct postulate OR Two or more correct limitations	Mentions the need of gathering of evidence and makes connections that lead to new discovery Bohr examined evidence collected by other scientists and recognised the connection between Balmer's equation, Planck's quanta and Einstein's idea that quanta applied to all electromagnetic radiations.	Ideally life is about learning from each other. Life is built on experiences and findings. How these findings and experiences are used to help those around us and lead to future discoveries. He combined their ideas and predicted that Planck's oscillators were electrons, that quanta were involved with electrons transferring	Invalid conceptual understanding	

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		<p>-it did not explain the differing intensity of spectral lines within the hydrogen spectrum</p> <p>-it could not account for the fact that a magnetic field split spectral lines into several thinner lines (Zeeman effect)</p> <p>-it was a mixture of classical and quantum physics</p>					
4.2: NUCLEAR PHYSICS							
4.2a	1	Nuclear fusion is a reaction through which two or more light nuclei collide into each other to form a heavier nucleus.	Correct answer or something to that effect.				Incorrect answer
4.2b	1	Nuclear fission is the splitting of a heavy atomic nucleus into two fragments, releasing a large amount of energy.	Correct answer or something to that effect.				Incorrect answer
4.2c	2	${}_{92}^{238}\text{U} \rightarrow \alpha_2^4 + \text{Th}_{90}^{234}$	Gets one of the products correctly written i.e. symbol, mass number and atomic number	Gets both the products correct and correctly written			Incorrect answer
4.2d	3	<p>A controlled chain reaction is one in which the energy released is maintained at a preset level and does not exceed this level.</p> <p>An uncontrolled chain reaction is one in which energy is released in increasing and uncontrollable amount.</p> <p>Both types of chain reaction require nuclear fuel, a transmutation.</p> <p>A controlled chain reaction uses control rods to absorb surplus neutrons as necessary whereas an</p>	Defines any one of the two types of nuclear chain reactions	<p>Defines the two types of nuclear chain reactions</p> <p>Or</p> <p>States the requirements of each type of nuclear chain reactions</p>	<p>Defines the two types of nuclear chain reactions</p> <p>States the requirements of each type of nuclear chain reactions</p> <p>Relates to the work of control rods</p> <p>(Full explanation)</p>		Invalid conceptual understanding

Item #	Skill Band	Evidence	Student Response Level				
			Unistructural	Multistructural	Relational	Extended Abstract	Weak
		uncontrolled chain reaction does not require control rods to absorb surplus neutrons thus the rate of nuclear transmutations continue to increase with an accompanying increase in the release of energy.					