

Compulsory Concepts on Which Students May Be Tested in Applied Science and Technology (557-410)

The scope of each concept is defined in the Progression of Learning. Educational institutions are responsible for testing the concepts shown in *italics*.

The following are also evaluated: Techniques related to diagram drawing and graphic representation (multiview orthogonal projection, isometric representation, perspective drawing, use of scales).

The Living World <i>Ch 10</i>	The Material World <i>Ch 3, 4, 5</i>	The Technological World <i>Ch 12, 13, 14</i>
<p>Dynamics of ecosystems</p> <ul style="list-style-type: none"> - Disturbances - Trophic relationships - Primary productivity - Material and energy flow - Chemical recycling - Factors that influence the distribution of biomes - Ecosystems 	<p>Chemical changes</p> <ul style="list-style-type: none"> - Combustion - Oxidation <p>Electricity</p> <ul style="list-style-type: none"> - Electrical charge - Static electricity - Ohm's law - Electrical circuits - Relationship between power and electrical energy <p>Electromagnetism</p> <ul style="list-style-type: none"> - Forces of attraction and repulsion - Magnetic field of a live wire - Magnetic field of a solenoid - Electromagnetic induction <p>Transformation of energy</p> <ul style="list-style-type: none"> - Law of conservation of energy - Energy efficiency - Distinction between heat and temperature <p>Fluids</p> <ul style="list-style-type: none"> - Archimedes' principle - Pascal's principle - Bernoulli's principle <p>Force and motion</p> <ul style="list-style-type: none"> - Force - Types of forces - Equilibrium of two forces - Relationship between constant speed, distance and time - Mass and weight 	<p>Graphical language <i>Ch 12</i></p> <ul style="list-style-type: none"> - Multiview orthogonal projection (general drawing) - Functional dimensioning - Developments (prism, cylinder, pyramid, cone) - Standards and representations (diagrams, symbols) <p>Mechanical engineering <i>Ch 13</i></p> <ul style="list-style-type: none"> - Adhesion and friction of parts - Linking of mechanical parts (degree of freedom of a part) - Guiding controls - Construction and characteristics of motion transmission systems (friction gears, pulleys and belt, gear assembly, sprocket wheels and chain, wheel and worm gear) - Speed changes, <i>resisting torque, engine torque</i> - Construction and characteristics of motion transformation systems (screw gear system, connecting rods, cranks, slides, cams, eccentrics and rotating slider crank mechanisms, rack-and-pinion drive) <p>Electrical engineering <i>Ch 14</i></p> <ul style="list-style-type: none"> - Power supply - Conduction, insulation and protection (resistance and coding, <i>printed circuit</i>) - Control [types: unipolar (single-pole), <i>bipolar (double-pole)</i>, unidirectional (single-throw), bidirectional (double-throw)] - Transformation of energy (electricity and light, heat, vibration, magnetism) - Other functions [capacitor (condenser), diode, <i>transistor, relay, other semi-conductors</i>] <p>Materials <i>Ch 12</i></p> <ul style="list-style-type: none"> - Constraints - Characteristics of mechanical properties - Heat treatments - Types and properties <ul style="list-style-type: none"> - Plastics (thermoplastics, thermosetting plastics) - Ceramics - Composites - Modification of properties (degradation, protection) <p>Manufacturing <i>Ch 13</i></p> <ul style="list-style-type: none"> - Manufacturing (characteristics of drilling, tapping, threading and bending) - Measurement and inspection <ul style="list-style-type: none"> - Direct measurement (<i>vernier caliper</i>) - Control, shape and position (<i>plane, section, angle</i>)
<p>The Earth and Space <i>Ch 6, Ch 7</i></p> <p>Lithosphere</p> <ul style="list-style-type: none"> - Minerals - Energy resources <p>Hydrosphere</p> <ul style="list-style-type: none"> - Catchment area - Energy resources <p>Atmosphere</p> <ul style="list-style-type: none"> - Air mass - Cyclone and anticyclone - Energy resources <p>Space</p> <ul style="list-style-type: none"> - Solar energy flow - Earth-Moon system (gravitational effect) <p><i>MC 1 } 8% SA 1 }</i></p>	<p>MC 9 } 44% SA 2 }</p>	<p><i>MC 5 } 48% SA 1 } Video 6 }</i></p>

Reference Tables

Guiding choices	
Translational	
Rotational	
Helical	

Characteristics of links	
Direct vs Indirect	
Removable vs Non-removable	
Rigid vs Flexible	
Complete vs Partial	

Trophic Levels	
Producers	
Consumers (1 st order, 2 nd order...)	
Decomposers	

Constraints	
Compression	
Tension	
Torsion	
Deflection	
Shearing	

Symbols for motion	
Unidirectional translation	
Bidirectional translation	
Unidirectional rotation	
Bidirectional rotation	
Unidirectional helical	
Bidirectional helical	

Symbols for links	
Complete	
Rotational guiding control	
Translational guiding control	
Rotational & Translational guiding control	

Mechanical properties	
Hardness	Resists dents
Elasticity	Returns to original shape
Resilience	Resists shocks
Ductility	Can be stretched out
Malleability	Can be Flattened/bent
Stiffness	Resists bending
Resistance to corrosion	Resists rusting
Electrical conductivity	Conducts or not
Thermal conductivity	Ability to transfer heat


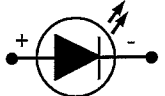
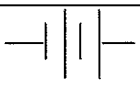

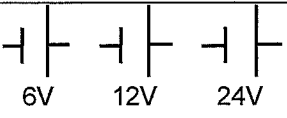

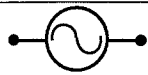
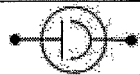





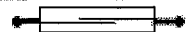

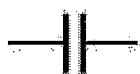

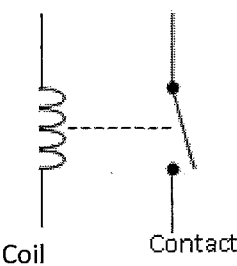
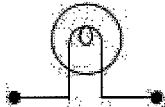





Properties of Materials	Ceramics	Thermo-plastics	Thermosetting plastics
Electrical conductivity	Low or none	None	None
Thermal conductivity	Low	Variable	Variable
Hardness	High	Variable	High
Elasticity	None	High	None
Lightness	Low	High	Low
Chemical neutrality	Variable	High	Low
Stiffness	High	Variable	High
Heat resistance	High	Variable	High
Corrosion resistance	High	High	High
Resilience	Low	High	High

Motion transmission systems		reversibility
Gear Train System		Yes
Chain & Sprocket System		Yes
Worm & Worm Gear System		NO
Friction Gear System		Yes
Belt & Pulley System		Yes

Motion transformation systems		reversibility
Rack & Pinion System		Yes
Screw Gear System type 1 screw is the driver	 The nut does not rotate! But moves to the left or right.	NO
Screw Gear System type 2 nut is the driver		NO
Cam & Follower System	 eccentric cam	NO
Slider-crank Mechanism		Yes

LIST OF SYMBOLS USED IN CIRCUIT DIAGRAMS

Students must be able to recognize these symbols in a given circuit diagram. However, if they are asked to draw a circuit diagram, they will be given a list of unidentified symbols.

Battery <i>A 1.5-volt battery</i>		Light-emitting diode (AST only)	
Two batteries <i>If there are two batteries, this provides 3 volts.</i>		Diode (AST only)	
More than two batteries <i>If there are more than two batteries, the voltage is indicated in the diagram.</i>		Wire	
Alternating current		Photoelectric cell	
Electrical outlet <i>When analyzing a technical object that uses alternating current, only the symbol for the power source is used to represent the power supply. The transformer is not included in the circuit diagram.</i>		Push-button switch	
Fuse		Rocker switch	
Resistor		Magnetic switch	
Motor		Capacitor (AST only)	
Light bulb		Relay (AST only) <i>The symbol on the right is used to represent a relay consisting of a coil in a low-voltage circuit that activates the contact in a high-voltage circuit.</i>	 Coil Contact
			
	<i>The symbol on the right is used to represent any type of indicator light in a technical object.</i>		
Speaker OR alarm		Ammeter	
Audible warning device		Voltmeter	
Heating element			

FORMULAS AND QUANTITIES

Applied Science and Technology

FORMULAS	
$V = RI$ <p>V : potential difference R : resistance I : electric current intensity</p> $E = P\Delta t$ <p>E : energy consumed P : electrical power Δt : time difference</p> $P = VI$ <p>P : electrical power V : potential difference I : electric current intensity</p>	$F_g = mg$ <p>F_g : gravitational force m : mass g : intensity of the gravitational field</p> $v = \frac{d}{\Delta t}$ <p>v : speed d : distance Δt : time difference</p>
Energy efficiency (%) = $\frac{\text{Amount of useful energy}}{\text{Amount of energy consumed}} \times 100$	

QUANTITIES		
NAME	SYMBOL	VALUE
Intensity of the gravitational field on Earth	g	9.8 N/kg
Kilowatt-hour	$\text{kW}\cdot\text{h}$	$1 \text{ kW}\cdot\text{h} = 3\,600\,000 \text{ J}$