The City School

Physics

O-Level

5054

Syllabus Content

August 2018 to May 2019

Physical Quantitates, units and measurement

1st Term		
		Learning outcomes
1.	**1. Physical Quantitates, units and measurement** 1.1 Scalars and vectors 1.2 Measurement techniques 1.3 Units and symbols	*Candidates should be able to:* *(a)* define the terms *scalar* and *vector*. *(c)* list the vectors and scalars from distance, displacement, length, speed, velocity, time, acceleration, mass and force. *(d)* describe how to measure a variety of lengths with appropriate accuracy using tapes, rules, micrometers and calipers. (The use of a vernier scale is **not** required.) *(e)* describe how to measure a variety of time intervals using clocks and stopwatches. *(f)* recognise and use the conventions and symbols contained in 'Signs, Symbols and Systematics', Association for Science Education, 2000.
2.	**2. Kinematics** **Content** 2.1 Speed, velocity and acceleration 2.2 Graphical analysis of motion	*Candidates should be able to:* *(a)* state what is meant by *speed* and *velocity*. *(b)* recall and use *average speed = distance travelled/time taken*. *(c)* state what is meant by *uniform acceleration* and recall and use *acceleration = change in velocity/time* *taken*. *(d)* discuss non-uniform acceleration. *(e)* recall that deceleration is a negative acceleration. *(f)* *plot and *interpret speed-time and distance-time graphs. *(g)* *recognise from the shape of a speed-time graph when a body is (1) at rest, (2) moving with uniform speed, (3) moving with uniform acceleration, (4) moving with non-uniform acceleration.
3.	**4. Mass, Weight and Density** **Content** 4.1 Mass and weight 4.2 Gravitational fields	*Candidates should be able to:* *(a)* state that mass is a measure of the amount of substance in a body. *(b)* state that the mass of a body resists change from its state of rest or motion. *(c)* state that a gravitational field is a region in which a mass experiences a force due to gravitational attraction. *(d)* recall and use the equation *weight = mass × gravitational field strength*. *(e)* explain that weights, and therefore masses, may be compared using a balance. *(f)* describe how to measure mass and weight by using appropriate balances.
4.	**3. Dynamics** **Content** 3.1 Balanced and unbalanced forces 3.2 Friction	*Candidates should be able to:* *(a)* state Newton's third law. *(b)* describe the effect of balanced and unbalanced forces on a body. *(c)* describe the ways in which a force may change the motion of a body. *(d)* recall and use the equation *force = mass × acceleration*. *(e)* explain that friction is a force that impedes motion and produces heating. *(f)* discuss the effect of friction on the motion of a vehicle in the context of tyre surface, road conditions (including skidding), braking force, braking distance, thinking distance and stopping distance.

	2. Kinematics **Content** 2.3 Free-fall	*Candidates should be able to:* *(h)* calculate the area under a speed-time graph to determine the distance travelled for motion with uniform speed or uniform acceleration. *(i)* state that the acceleration of free-fall for a body near to the Earth is constant and is approximately 10 m / s_2. *(j)* describe qualitatively the motion of bodies with constant weight falling with and without air resistance (including reference to terminal velocity).
	1. Physical Quantitates, units and measurement 1.1 Scalars and vectors	*(b)* determine the resultant of two vectors by a graphical method.
5.	**3. Dynamics** **Content** 3.3 Circular motion	*Candidates should be able to:* *(g)* describe qualitatively motion in a circular path due to a constant perpendicular force, including electrostatic forces on an electron in an atom and gravitational forces on a satellite. (*F* = *mv* 2*/r* is **not** required.) *(h)* discuss how ideas of circular motion are related to the motion of planets in the solar system.
6.	**4. Mass, Weight and Density** **Content** 4.3 Density	*Candidates should be able to* *(g)* describe how to use a measuring cylinder to measure the volume of a liquid or solid. *(h)* describe how to determine the density of a liquid, of a regularly shaped solid and of an irregularly shaped solid which sinks in water (volume by displacement). *(i)* define density and recall and use the formula *density = mass/volume*.
7.	**6. Deformation** **Content** 6.1 Elastic deformation	*Candidates should be able to:* *(a)* state that a force may produce a change in size and shape of a body. *(b)* *plot, draw and interpret extension-load graphs for an elastic solid and describe the associated experimental procedure. *(c)* *recognise the significance of the term “limit of proportionality” for an elastic solid (an understanding of the elastic limit is **not** required). *(d)* calculate extensions for an elastic solid using proportionality.

2nd Term		
		Learning outcomes
	5. Turning Effect of Forces **Content** 5.1 Moments 5.2 Centre of mass 5.3 Stability	*Candidates should be able to:* *(a)* describe the moment of a force in terms of its turning effect and relate this to everyday examples. *(b)* state the principle of moments for a body in equilibrium. *(c)* define *moment of a force* and recall and use the formula *moment = force × perpendicular distance from the pivot* and the principle of moments. *(d)* describe how to verify the principle of moments. *(e)* describe how to determine the position of the centre of mass of a plane lamina. *(f)* describe qualitatively the effect of the position of the centre of mass on the stability of simple objects.
	7. Pressure **Content** 7.1 Pressure 7.2 Pressure changes	*Candidates should be able to:* *(a)* define the term *pressure* in terms of force and area, and do calculations using the equation *pressure = force/area*. *(b)* explain how pressure varies with force and area in the context of everyday examples. *(c)* describe how the height of a liquid column may be used to measure the atmospheric pressure. *(d)* explain quantitatively how the pressure beneath a liquid surface changes with depth and density of the liquid in appropriate examples. *(e)* recall and use the equation for hydrostatic pressure $p = \rho gh$. *(f)* describe the use of a manometer in the measurement of pressure difference. *(g)* describe and explain the transmission of pressure in hydraulic systems with particular reference to the hydraulic press and hydraulic brakes on vehicles. *(h)* describe how a change in volume of a fixed mass of gas at constant temperature is caused by a change in pressure applied to the gas. *(i)* recall and use $p1V1 = p2V$
	8. Energy Sources and Transfer of Energy **Content** 8.1 Energy forms 8.2 Major sources of energy 8.3 Work 8.4 Efficiency 8.5 Power	*Candidates should be able to:* *(a)* list the different forms of energy with examples in which each form occurs. *(b)* state the principle of the conservation of energy and apply this principle to the conversion of energy from one form to another. *(c)* state that kinetic energy is given by $Ek = \frac{1}{2}mv^2$ and that gravitational potential energy is given by $EP = mgh$, and use these equations in calculations. *(d)* list renewable and non-renewable energy sources. *(e)* describe the processes by which energy is converted from one form to another, including reference to (1) chemical/fuel energy (a re-grouping of atoms), (2) hydroelectric generation (emphasising the mechanical energies involved), (3) solar energy (nuclei of atoms in the Sun), (4) nuclear energy, (5) geothermal energy, (6) wind energy. *(f)* explain nuclear fusion and fission in terms of energy-releasing processes. *(g)* describe the process of electricity generation and draw a block diagram of the process from fuel input to electricity output. *(h)* discuss the environmental issues associated with power generation. *(i)* define work done and use the formula *work = force × distance moved in the line of action of the force*. *(j)* recall and use the formula *efficiency = energy converted to the required form/total energy input* for an

		energy conversion. *(k)* discuss the efficiency of energy conversions in common use, particularly those giving electrical output. *(l)* discuss the usefulness of energy output from a number of energy conversions. *(m)* define power and recall and use the formula *power = work done/time taken.*
	12. Kinetic Model of Matter **Content** 12.1 States of matter 12.2 Molecular model 12.3 Evaporation	*Candidates should be able to:* *(a)* state the distinguishing properties of solids, liquids and gases. *(b)* describe qualitatively the molecular structure of solids, liquids and gases, relating their properties to the forces and distances between molecules and to the motion of the molecules. *(c)* describe the relationship between the motion of molecules and temperature. *(d)* explain the pressure of a gas in terms of the motion of its molecules. *(e)* describe evaporation in terms of the escape of more energetic molecules from the surface of a liquid. *(f)* describe how temperature, surface area and draught over a surface influence evaporation. *(g)* explain that evaporation causes cooling.
	9. Transfer of Thermal Energy **Content** 9.1 Conduction 9.2 Convection 9.3 Radiation	*Candidates should be able to:* *(a)* describe how to distinguish between good and bad conductors of heat. *(b)* describe, in terms of the movement of molecules or free electrons, how heat transfer occurs in solids. *(c)* describe convection in fluids in terms of density changes. *(d)* describe the process of heat transfer by radiation. *(e)* describe the effect of surface colour (black or white) and texture (dull or shiny) on the emission, absorption and reflection of radiation. *(f)* describe how to distinguish between good and bad emitters and good and bad absorbers of infra-red radiation. *(g)* describe how heat is transferred to or from buildings and to or from a room. *(h)* state and explain the use of the important practical methods of thermal insulation for buildings.
End of 2nd Term		