*The City School*

Physics

O-Level

5054

# Class 10

**Syllabus Content**

**August 2018 to May 2019**

| 1st Term | | |
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| | | **Learning outcomes** |
| 1. | **10. Temperature**<br>**Content**<br>10.1 Principles of thermometry<br>10.2 Practical thermometers | *Candidates should be able to:*<br>*(a)* explain how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties.<br>*(b)* explain the need for fixed points and state what is meant by the *ice point* and *steam point*.<br>*(c)* discuss sensitivity, range and linearity of thermometers.<br>*(d)* describe the structure and action of liquid-in-glass thermometers (including clinical) and of a thermocouple thermometer, showing an appreciation of its use for measuring high temperatures and those which vary rapidly.<br>*(e)* describe and explain how the structure of a liquid-in-glass thermometer affects its sensitivity, range and linearity. |
| 2. | **11. Thermal Properties of Matter**<br>**Content**<br>11.1 Specific heat capacity<br>11.2 Melting and boiling<br>11.3 Thermal expansion of solids, liquids and gases | *Candidates should be able to:*<br>*(a)* describe a rise in temperature of a body in terms of an increase in its internal energy (random thermal energy).<br>*(b)* define the terms *heat capacity* and *specific heat capacity*.<br>*(c)* recall and use the formula *thermal energy = mass × specific heat capacity × change in temperature*.<br>*(d)* describe melting/solidification and boiling/condensation in terms of energy transfer without a change in temperature.<br>*(e)* state the meaning of *melting point* and *boiling point*.<br>*(f)* explain the difference between boiling and evaporation.<br>*(g)* define the terms *latent heat* and *specific latent heat*.<br>*(h)* explain latent heat in terms of molecular behaviour.<br>*(i)* calculate heat transferred in a change of state using the formula *thermal energy = mass × specific latent heat*.<br>*(j)* describe qualitatively the thermal expansion of solids, liquids and gases.<br>*(k)* describe the relative order of magnitude of the expansion of solids, liquids and gases.<br>*(l)* list and explain some of the everyday applications and consequences of thermal expansion.<br>*(m)* describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure. |
| 3. | **14. Light**<br>**Content**<br>14.1 Reflection of light<br>14.2 Refraction of light<br>14.3 Thin converging and diverging lenses | *Candidates should be able to:*<br>*(a)* define the terms used in reflection including *normal*, *angle of incidence* and *angle of reflection*.<br>*(b)* describe an experiment to illustrate the law of reflection.<br>*(c)* describe an experiment to find the position and characteristics of an optical image formed by a plane mirror.<br>*(d)* state that for reflection, the angle of incidence is equal to the angle of reflection and use this in constructions, measurements and calculations.<br>*(e)* define the terms used in refraction including *angle of incidence*, *angle of refraction* and *refractive index*. |

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| | | *(f)* describe experiments to show refraction of light through glass blocks.<br>*(g)* recall and use the equation sin *i* /sin *r* = *n*.<br>*(h)* define the terms *critical angle* and *total internal reflection* and recall and use the formula sin *c* = 1/*n.*<br>*(i)* describe experiments to show total internal reflection.<br>*(j)* describe the use of optical fibres in telecommunications and state the advantages of their use.<br>*(k)* describe the action of thin lenses (both converging and diverging) on a beam of light.<br>*(l)* define the term *focal length*.<br>*(m)* *draw ray diagrams to illustrate the formation of real and virtual images of an object by a converging<br>lens, and the formation of a virtual image by a diverging lens.<br>*(n)* define the term *linear magnification* and *draw scale diagrams to determine the focal length needed for<br>particular values of magnification (converging lens only).<br>*(o)* describe the use of a single lens as a magnifying glass and in a camera, projector and photographic<br>enlarger and draw ray diagrams to show how each forms an image.<br>*(p)* draw ray diagrams to show the formation of images in the normal eye, a short-sighted eye and a<br>long-sighted eye.<br>*(q)* describe the correction of short-sight and long-sight. |
| 4. | **13. General Wave Properties**<br>**Content**<br>13.1 Describing wave motion<br>13.2 Wave terms<br>13.3 Wave behavior | *Candidates should be able to:*<br>*(a)* describe what is meant by wave motion as illustrated by vibrations in ropes and springs and by<br>experiments using a ripple tank.<br>*(b)* state what is meant by the term *wavefront*.<br>*(c)* define the terms *speed*, *frequency*, *wavelength* and *amplitude* and recall and use the formula<br>*velocity* = *frequency* × *wavelength*.<br>*(d)* describe transverse and longitudinal waves in such a way as to illustrate the differences between them.<br>*(e)* describe the use of a ripple tank to show<br>(1) reflection at a plane surface,<br>(2) refraction due to a change of speed at constant frequency.<br>*(f)* describe simple experiments to show the reflection of sound waves. |
| 5. | **15. Electromagnetic Spectrum**<br>**Content**<br>15.1 Dispersion of light<br>15.2 Properties of electromagnetic waves<br>15.3 Applications of electromagnetic waves | *Candidates should be able to:*<br>*(a)* describe the dispersion of light as illustrated by the action on light of a glass prism.<br>*(b)* state the colours of the spectrum and explain how the colours are related to frequency/wavelength.<br>*(c)* state that all electromagnetic waves travel with the same high speed in air and state the magnitude of<br>that speed.<br>*(d)* describe the main components of the electromagnetic spectrum.<br>*(e)* discuss the role of the following components in the stated applications:<br>(1) radio waves – radio and television communications,<br>(2) microwaves – satellite television and telephone,<br>(3) infra-red – household electrical appliances, television controllers and intruder alarms,<br>(4) light – optical fibres in medical uses and telephone,<br>(5) ultra-violet – sunbeds, fluorescent tubes and sterilisation,<br>(6) X-rays – hospital use in medical imaging and killing cancerous cells, and engineering applications<br>such as detecting cracks in metal, |

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| | | (7) gamma rays – medical treatment in killing cancerous cells, and engineering applications such as<br>detecting cracks in metal. |
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| **End of Term** | | |

| **2nd Term** | | |
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| | | **Learning outcomes** |
| 1. | **16. Sound**<br>**Content**<br>16.1 Sound waves<br>16.2 Speed of sound<br>16.3 Ultrasound | *Candidates should be able to:*<br>*(a)* describe the production of sound by vibrating sources.<br>*(b)* describe the longitudinal nature of sound waves and describe compression and rarefaction.<br>*(c)* state the approximate range of audible frequencies for the healthy human ear as 20 Hz to 20 000 Hz.<br>*(d)* explain why a medium is required in order to transmit sound waves and describe an experiment to<br>demonstrate this.<br>*(e)* describe a direct method for the determination of the speed of sound in air and make the necessary<br>calculation.<br>*(f)* state the order of magnitude of the speeds of sound in air, liquids and solids.<br>*(g)* explain how the loudness and pitch of sound waves relate to amplitude and frequency.<br>*(h)* describe how the reflection of sound may produce an echo.<br>*(i)* describe how the shape of a sound wave as demonstrated by an oscilloscope is affected by the quality<br>(timbre) of the sound wave.<br>*(j)* define *ultrasound*.<br>*(k)* describe the uses of ultrasound in cleaning, quality control and pre-natal scanning. |
| 2. | **18. Static Electricity**<br>**Content**<br>18.1 Laws of electrostatics<br>18.2 Principles of electrostatics<br>18.3 Applications of electrostatics | *Candidates should be able to:*<br>*(a)* describe experiments to show electrostatic charging by friction.<br>*(b)* explain that charging of solids involves a movement of electrons.<br>*(c)* state that there are positive and negative charges and that charge is measured in coulombs.<br>*(d)* state that unlike charges attract and like charges repel.<br>*(e)* describe an electric field as a region in which an electric charge experiences a force.<br>*(f)* state the direction of lines of force and describe simple field patterns.<br>*(g)* describe the separation of charges by induction.<br>*(h)* discuss the differences between electrical conductors and insulators and state examples of each.<br>*(i)* state what is meant by *"earthing"* a charged object.<br>*(j)* describe examples where charging could be a problem, e.g. lightning.<br>*(k)* describe examples where charging is helpful, e.g. photocopier and electrostatic precipitator. |
| 3. | **19. Current Electricity** | *Candidates should be able to:*<br>*(a)* state that a current is a flow of charge and that current is measured in amperes. |

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| | **Content**<br>19.1 Current<br>19.2 Electromotive force<br>19.3 Potential difference<br>19.4 Resistance | *(b)* recall and use the equation *charge = current × time*.<br>*(c)* describe the use of an ammeter with different ranges.<br>*(d)* explain that electromotive force (e.m.f.) is measured by the energy dissipated by a source in driving a<br>unit charge around a complete circuit.<br>*(e)* state that e.m.f. is work done/charge.<br>*(f)* state that the volt is given by J / C.<br>*(g)* calculate the total e.m.f. where several sources are arranged in series and discuss how this is used in<br>the design of batteries.<br>*(h)* discuss the advantage of making a battery from several equal voltage sources of e.m.f. arranged in<br>parallel.<br>*(i)* state that the potential difference (p.d.) across a circuit component is measured in volts.<br>*(j)* state that the p.d. across a component in a circuit is given by the work done in the component/charge<br>passed through the component.<br>*(k)* describe the use of a voltmeter with different ranges.<br>*(l)* state that *resistance = p.d./current* and use the equation *resistance = voltage/current* in calculations.<br>*(m)* describe an experiment to measure the resistance of a metallic conductor using a voltmeter and an<br>ammeter and make the necessary calculations.<br>*(n)* state Ohm's Law and discuss the temperature limitation on Ohm's Law.<br>*(o)* *use quantitatively the proportionality between resistance and the length and the cross-sectional area of<br>a wire.<br>*(p)* calculate the net effect of a number of resistors in series and in parallel.<br>*(q)* describe the effect of temperature increase on the resistance of a resistor and a filament lamp and draw<br>the respective sketch graphs of current/voltage.<br>*(r)* describe the operation of a light-dependent resistor. |
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| **End of Term** | | |