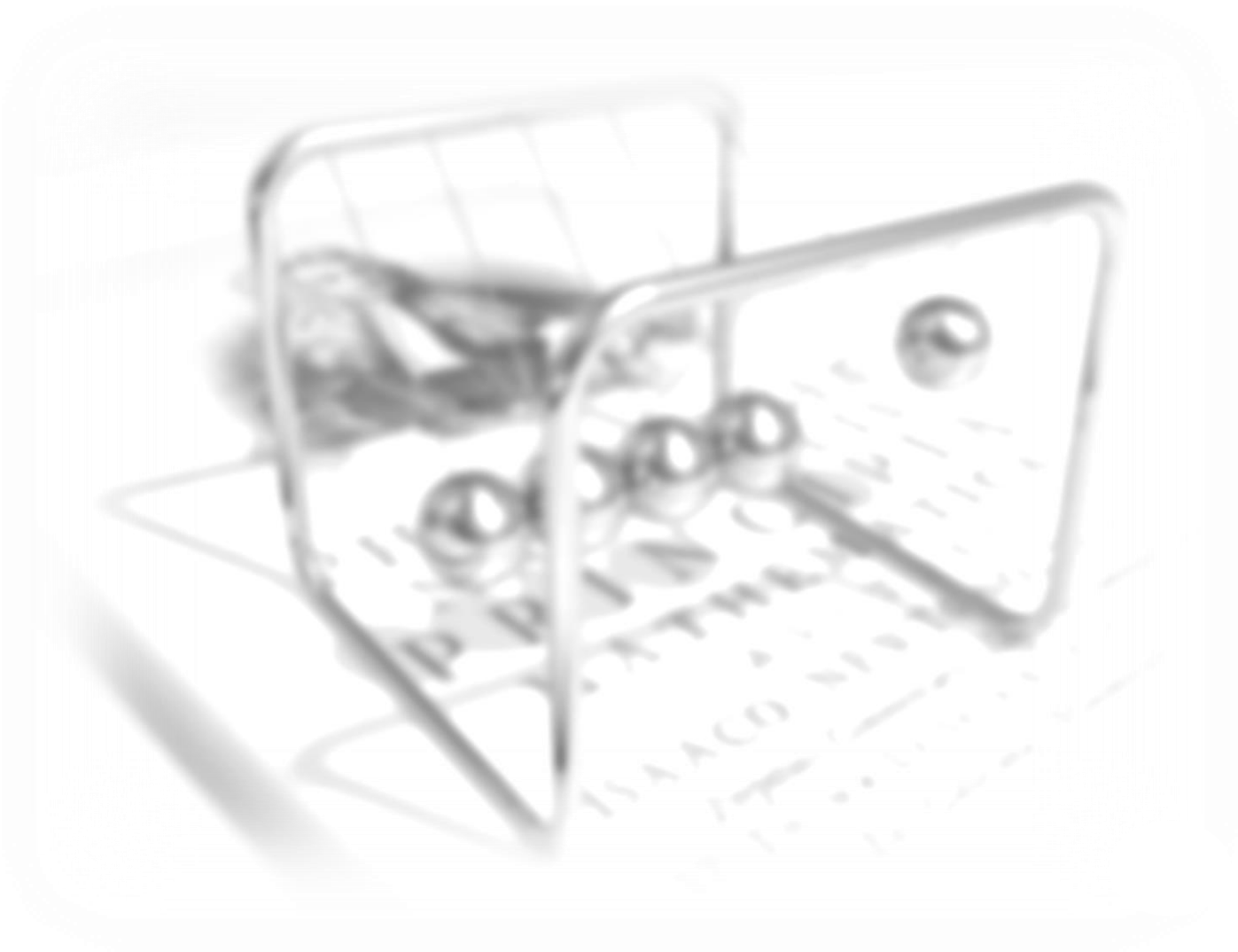
Name:

COMBINED SCIENCE

Topics 4, 5 & 6

LEARNING OUTCOMES



Maintain a record of your progress

Use the booklet to guide revision

Close the Gap

Contemporary record of the Topics / Learning outcomes that I am finding toughest:

Topic 4 - Waves

4.1	Recall that waves transfer energy and information without transferring matter	☹ 😐 ☺
4.2	Describe evidence that with water and sound waves it is the wave and not the water or air itself that travels	☹ 😐 ☺
4.3	Define and use the terms frequency and wavelength as applied to waves	☹ 😐 ☺
4.4	Use the terms, amplitude, period and wave velocity as applied to waves	☹ 😐 ☺
4.5	Describe the difference between longitudinal and transverse waves by referring to sound, electromagnetic, seismic and water waves	☹ 😐 ☺
4.6	Recall and use both the equations below for all waves: wave speed = frequency × wavelength wave speed = distance ÷ time	☹ 😐 ☺
4.7	Describe how to measure the velocity of sound in air and ripples on water surfaces	☹ 😐 ☺
4.10	Explain how waves will be refracted at a boundary in terms of the change of direction and speed	☹ 😐 ☺
4.11	Recall that different substances may absorb, transmit, refract or reflect waves in ways that vary with wavelength	☹ 😐 ☺
4.17	Core Practical: Investigate the suitability of equipment to measure the speed, frequency and wavelength of a wave in a solid and a fluid	☹ 😐 ☺

Topic 5 – Light and the electromagnetic spectrum

5.7	Recall that all electromagnetic waves are transverse, that they travel at the same speed in a vacuum	☹ 😐 ☺
5.8	Explain, with examples, that all electromagnetic waves transfer energy from source to observer	☹ 😐 ☺
5.9	Investigate refraction in rectangular glass blocks in terms of the interaction of electromagnetic waves with matter	☹ 😐 ☺
5.10	Recall the main groupings of the continuous electromagnetic spectrum including (in order) radio waves, microwaves, infrared, visible (including the colours of the visible spectrum), ultraviolet, x-rays and gamma rays	☹ 😐 ☺
5.11	Describe the electromagnetic spectrum as continuous from radio waves to gamma rays and that the radiations within it can be grouped in order of decreasing wavelength and increasing frequency	☹ 😐 ☺
5.12	Recall that our eyes can only detect a limited range of frequencies of electromagnetic radiation	☹ 😐 ☺
5.13	Recall that different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength	☹ 😐 ☺
5.14	Explain the effects of differences in the velocities of electromagnetic waves in different substances	☹ 😐 ☺
5.20	Recall that the potential danger associated with an electromagnetic wave increases with increasing frequency	☹ 😐 ☺
5.21	Describe the harmful effects on people of excessive exposure to electromagnetic radiation, including: a microwaves: internal heating of body cells b infrared: skin burns c ultraviolet: damage to surface cells and eyes, leading to skin cancer	☹ 😐 ☺

	and eye conditions d x-rays and gamma rays: mutation or damage to cells in the body	
5.22	Describe some uses of electromagnetic radiation a radio waves: including broadcasting, communications and satellite transmissions b microwaves: including cooking, communications and satellite transmissions c infrared: including cooking, thermal imaging, short range communications, optical fibres, television remote controls and security systems d visible light: including vision, photography and illumination e ultraviolet: including security marking, fluorescent lamps, detecting forged bank notes and disinfecting water f x-rays: including observing the internal structure of objects, airport security scanners and medical x-rays g gamma rays: including sterilising food and medical equipment, and the detection of cancer and its treatment	☹ 😐 ☺
5.23	Recall that radio waves can be produced by, or can themselves induce, oscillations in electrical circuits	☹ 😐 ☺
5.24	Recall that changes in atoms and nuclei can a generate radiations over a wide frequency range b be caused by absorption of a range of radiations	☹ 😐 ☺

Topic 6 - Radioactivity

6.1	Describe an atom as a positively charged nucleus, consisting of protons and neutrons, surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with almost all of the mass in the nucleus	☹ 😐 ☺
6.2	Recall the typical size (order of magnitude) of atoms and small molecules	☹ 😐 ☺
6.3	Describe the structure of nuclei of isotopes using the terms atomic (proton) number and mass (nucleon) number and using symbols in the format using symbols in the format $^{13}_{6}C$	☹ 😐 ☺
6.4	Recall that the nucleus of each element has a characteristic positive charge, but that isotopes of an element differ in mass by having different numbers of neutrons	☹ 😐 ☺
6.5	Recall the relative masses and relative electric charges of protons, neutrons, electrons and positrons	☹ 😐 ☺
6.6	Recall that in an atom the number of protons equals the number of electrons and is therefore neutral	☹ 😐 ☺
6.7	Recall that in each atom its electrons orbit the nucleus at different set distances from the nucleus	☹ 😐 ☺
6.8	Explain that electrons change orbit when there is absorption or emission of electromagnetic radiation	☹ 😐 ☺
6.9	Explain how atoms may form positive ions by losing outer electrons	☹ 😐 ☺
6.10	Recall that alpha, β– (beta minus), β+ (positron), gamma rays and neutron radiation are emitted from unstable nuclei in a random process	☹ 😐 ☺
6.11	Recall that alpha, β– (beta minus), β+ (positron) and gamma rays are ionising radiations	☹ 😐 ☺
6.12	Explain what is meant by background radiation	☹ 😐 ☺

6.13	Describe the origins of background radiation from Earth and space	
6.14	Describe methods for measuring and detecting radioactivity limited to photographic film and a Geiger–Müller tube	
6.15	Recall that an alpha particle is equivalent to a helium nucleus, a beta particle is an electron emitted from the nucleus and a gamma ray is electromagnetic radiation	
6.16	Compare alpha, beta and gamma radiations in terms of their abilities to penetrate and ionise	
6.17	Describe how and why the atomic model has changed over time including reference to the plum pudding model and Rutherford alpha particle scattering leading to the Bohr model	
6.18	Describe the process of β– decay (a neutron becomes a proton plus an electron)	
6.19	Describe the process of β+ decay (a proton becomes a neutron plus a positron)	
6.20	Explain the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays (α, β, γ and neutron emission)	
6.21	Recall that nuclei that have undergone radioactive decay often undergo nuclear rearrangement with a loss of energy as gamma radiation	
6.22	Use given data to balance nuclear equations in terms of mass and charge	
6.23	Describe how the activity of a radioactive source decreases over a period of time	
6.24	Recall that the unit of activity of a radioactive isotope is the Becquerel, Bq	
6.25	Explain that the half-life of a radioactive isotope is the time taken for half the undecayed nuclei to decay or the activity of a source to decay by half	
6.26	Explain that it cannot be predicted when a particular nucleus will decay but half-life enables the activity of a very large number of nuclei to be predicted during the decay process	
6.27	Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations	
6.29	Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed	
6.31	Explain the precautions taken to ensure the safety of people exposed to radiation, including limiting the dose for patients and the risks to medical personnel	
6.32	Describe the differences between contamination and irradiation effects and compare the hazards associated with these two	

Notes:

You must know, and be able to use, these equations:

wave velocity = frequency x wavelength

$v = f \times \lambda$

metres per second (m/s) = hertz (hz) x metres (m)

wave velocity = distance / time

$v = x / t$

metres per second (m/s) = metres (m) / seconds (s)