Overview of YEAR 12 SPRING MECHANICS

Week	Statements	Teaching activities	Notes
1	3.01a Understand and be able to use the fundamental quantities and units in the S.I. system: length (in metres), time (in seconds), mass (in kilograms). *Learners should understand that these three base quantities are mutually independent.*		CHAPTER 19 INTRODUCTION TO KINEMATICS SECTION 1 MATHEMATICAL MODELS IN MECHANICS Page 421 EXERCISE 19A Page 423 SECTION 2 DISPLACEMENT, VELOCITY AND ACCELERATION Page 423-426 EXERCISE 19B Page 427
	3.01b Understand and be able to use derived quantities and units: velocity (m/s or m s^{-1}), acceleration (m/s^2 or m s^{-2}), force (N), weight (N). *Learners should be able to add the appropriate unit to a given quantity.*		
	3.02a Understand and be able to use the language of kinematics: position,		

	displacement, distance, distance travelled, velocity, speed, acceleration, equation of motion. *Learners should understand the vector nature of displacement, velocity and acceleration and the scalar nature of distance travelled and speed.*		

Week	**Statements**	**Teaching activities**	**Notes**
2	3.02c Be able to interpret displacement-time and velocitytime graphs, and in particular understand and be able to use the facts that the gradient of a displacement-time graph represents the velocity, the gradient of a velocity-time graph represents the acceleration, and the area between the graph and the time axis for a velocity-time graph represents the displacement.		SECTION 4 USING TRAVEL GRAPHS Page 432-437 EXERCISE 19D Page 438-440

Week	**Statements**	**Teaching activities**	**Notes**
3	3.02f Be able to use differentiation and integration with respect to time in one		SECTION 3 KINEMATICS AND CALCULUS Page 428-430

	dimension to solve simple problems concerning the displacement, velocity and acceleration of a particle: $$v = \frac{\mathrm{d}s}{\mathrm{d}t}$$ $$a = \frac{\mathrm{d}v}{\mathrm{d}t} = \frac{\mathrm{d}^2 s}{\mathrm{d}t^2}$$ $s = \int v\mathrm{d}t$ and $v = \int a\mathrm{d}t$		EXERCISE 19C Page 431-432

Week	Statements	Teaching activities	Notes
4	3.02b Understand, use and interpret graphs in kinematics for motion in a straight line.		AVERAGE SPEED AND AVERAGE VELOCITY Page 441-442 EXERCISE 19E Page 443-445

Week	Statements	Teaching activities	Notes
5	3.02a Understand and be able to use the language of kinematics: position, displacement, distance, distance travelled, velocity, speed, acceleration, equation of motion. *Learners should understand the vector nature of displacement, velocity and*		SECTION 5 SOLVING PROBLEMS IN KINEMATICS Page 445-449 EXERCISE 19F Page 450-451 MIXED PRACTICE 19 Page 452-454

	acceleration and the scalar nature of distance travelled and speed.		

Week	Statements	Teaching activities	Notes
6	3.02d Understand, use and derive the formulae for constant acceleration for motion in a straight line: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2}(u + v)t$ $v^2 = u^2 + 2as$ $s = vt - \frac{1}{2}at^2$ *Learners may be required to derive the constant acceleration formulae using a variety of techniques:* *1. by integration, e.g.* $v = \int a\mathrm{d}t \Rightarrow v = u + at$ *2. by using and interpreting appropriate graphs, e.g. velocity against time,* *3. by substitution of one (given) formula into another (given) formula, e.g. substituting* $v = u + at$ *into* $s = \frac{1}{2}(u + v)t$ *to obtain* $s = ut + \frac{1}{2}at^2$.		CHAPTER 20 MOTION WITH CONSTANT ACCELERATION SECTION 1 Deriving the Constant Acceleration Formulae Page 455-458 EXERCISE 20A Page 459-460

Week	Statements	Teaching activities	Notes
7	3.02d Understand, use and derive the formulae for constant acceleration for motion in a straight line: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2}(u + v)t$ $v^2 = u^2 + 2as$ $s = vt - \frac{1}{2}at^2$ *Learners may be required to derive the constant acceleration formulae using a variety of techniques:* *1. by integration, e.g.* $v = \int a\mathrm{d}t \Rightarrow v = u + at$ *2. by using and interpreting appropriate graphs, e.g. velocity against time,* *3. by substitution of one (given) formula into another (given) formula, e.g. substituting* $v = u + at$ *into* $s = \frac{1}{2}(u + v)t$ *to obtain* $s = ut + \frac{1}{2}at^2$*.*		SECTION 2 USING THE CONSTANT ACCELERATION FORMULAE Page 460-461 EXERCISE 20B Page 462

Week	Statements	Teaching activities	Notes
8	3.03g Understand the gravitational acceleration, *g*, and its value in S.I. units to varying degrees of accuracy.		SECTION 3 VERTICAL MOTION UNDER GRAVITY Page 463-468

	The value of g may be assumed to take a constant value of 9.8 ms^{-2} but learners should be aware that g is not a universal constant but depends on location in the universe. [*The inverse square law for gravitation is not required.*]		EXERCISE 20C Page 469-470

Week	**Statements**	**Teaching activities**	**Notes**
9	3.02d Understand, use and derive the formulae for constant acceleration for motion in a straight line: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2}(u + v)t$ $v^2 = u^2 + 2as$ $s = vt - \frac{1}{2}at^2$ *Learners may be required to derive the constant acceleration formulae using a variety of techniques:* *1. by integration, e.g.* $v = \int a\mathrm{d}t \Rightarrow v = u + at$ *2. by using and interpreting appropriate graphs, e.g. velocity against time,* *3. by substitution of one (given)*		SECTION 4 MULTI STAGE PROBLEMS Page 470-474 EXERCISE 20D Page 475-476 MIXED PRACTICE 20 Page 477-478

	formula into another (given) formula, e.g. substituting $v = u + at$ *into* $s = \frac{1}{2}(u + v)t$ *to obtain* $s = ut + \frac{1}{2}at^2$.		

Week	Statements	Teaching activities	Notes
10	3.03b Understand and be able to use Newton's first law. *A particle that is at rest (or moving with constant velocity) will remain at rest (or moving with constant velocity) until acted upon by an external force.* *Learners should be able to complete a diagram with the force(s) required for a given body to remain in equilibrium.*		CHAPTER 21 FORCE AND MOTION SECTION 1 NEWTONS LAWS OF MOTION Page 479-480 EXERCISE 21A Page 482-483
	3.03c Understand and be able to use Newton's second law $(F = ma)$ for motion in a straight line for bodies of constant mass moving under the action of constant forces. *e.g. A car moving along a road, a passenger riding in a lift or a crane lifting a weight.* *For stage 1 learners, examples can be*		

	restricted to problems in which the forces acting on the body will be collinear, in two perpendicular directions or given as 2-D vectors.		

Week	**Statements**	**Teaching activities**	**Notes**
11	3.03a Understand the concept and vector nature of a force. *A force has both a magnitude and direction and can cause an object with a given mass to change its velocity.* *Includes using directed line segments to represent forces (acting in at most two dimensions).* *Learners should be able to identify the forces acting on a system and represent them in a force diagram.*		SECTION 2 COMBINING FORCES Page 484-486 EXERCISE 21B Page 486-489

Week	**Statements**	**Teaching activities**	**Notes**
12	3.03a Understand the concept and vector nature of a force.		SECTION 3 TYPES OF FORCE Page 489-492

	A force has both a magnitude and direction and can cause an object with a given mass to change its velocity. *Includes using directed line segments to represent forces (acting in at most two dimensions).* *Learners should be able to identify the forces acting on a system and represent them in a force diagram.*		EXERCISE 21C Page 493
	3.03r Understand the concept of a frictional force and be able to apply it in contexts where the force is given in vector or component form, or the magnitude and direction of the force are given.		

Week	**Statements**	**Teaching activities**	**Notes**
13	3.03f Understand and be able to use the weight $(W = mg)$ of a body to model the motion in a straight line under gravity. *e.g. A ball falling through the air.*		SECTION 4 GRAVITY AND WEIGHT Page 494-496 EXERCISE 21D Page 497-498

	3.03g Understand the gravitational acceleration, *g*, and its value in S.I. units to varying degrees of accuracy. *The value of g may be assumed to take a constant value of 9.8 ms^{-2} but learners should be aware that g is not a universal constant but depends on location in the universe.* [*The inverse square law for gravitation is not required.*]		

Week	Statements	Teaching activities	Notes
14	3.03n Be able to solve problems involving simple cases of equilibrium of forces on a particle in two dimensions using vectors, including connected particles and smooth pulleys. *e.g. Finding the required force $\boldsymbol{F}$ for a particle to remain in equilibrium when under the action of forces $\boldsymbol{F}_1$, $\boldsymbol{F}_2$, . . .* *For stage 1 learners, examples can be restricted to problems in which the forces acting on the body will be collinear, in two perpendicular directions or given as 2-D vectors.*		SECTION 5 FORCES IN EQUILIBRIUM Page 498-500 EXERCISE 21E Page 500-502 MIXED PRACTICE 21 Page 503-505

Week	Statements	Teaching activities	Notes
15	3.03h Understand and be able to use Newton's third law. *Every action has an equal and opposite reaction.* *Learners should understand and be able to use the concept that a system in which none of its components have any relative motion may be modelled as a single particle.*		CHAPTER 22 OBJECTS IN CONTACT SECTION 1 NEWTON'S THIRD LAW Page 507-508 EXERCISE 22A Page 508

Week	Statements	Teaching activities	Notes
16	3.03l Understand and be able to use the concept of a normal reaction force. *Learners should understand and use the result that when an object is resting on a horizontal surface the normal reaction force is equal and opposite to the weight of the object. This includes knowing that when* $R = 0$ *contact is lost.*		SECTION 2 NORMAL REACTION FORCE Page 508-513 EXERCISE 22B Page 514-515

Week	Statements	Teaching activities	Notes
17	3.03k Be able to use the concept of equilibrium together with one dimensional motion in a straight line to solve problems that involve connected particles and smooth pulleys. *e.g. A train engine pulling a train carriage(s) along a straight horizontal track or the vertical motion of two particles, connected by a light inextensible string passing over a fixed smooth peg or light pulley.*		SECTION 3 FURTHER EQUILIBRIUM PROBLEMS Page 515-517 EXERCISE 22C Page 518-519

Week	Statements	Teaching activities	Notes
18	3.03k Be able to use the concept of equilibrium together with one dimensional motion in a straight line to solve problems that involve connected particles and smooth pulleys. *e.g. A train engine pulling a train carriage(s) along a straight horizontal track or the vertical motion of two particles, connected by a light*		SECTION 4 CONNECTED PARTICLES Page 519-522 EXERCISE 22D Page 522-523

	inextensible string passing over a fixed smooth peg or light pulley.		

Week	**Statements**	**Teaching activities**	**Notes**
19	3.03k Be able to use the concept of equilibrium together with one dimensional motion in a straight line to solve problems that involve connected particles and smooth pulleys. *e.g. A train engine pulling a train carriage(s) along a straight horizontal track or the vertical motion of two particles, connected by a light inextensible string passing over a fixed smooth peg or light pulley.*		SECTION 5 PULLEYS Page 523-527 EXERCISE 22E Page 527-530

Week	**Statements**	**Teaching activities**	**Notes**
20			MIXED PRACTICE 22 Page 531-535

Week	Statements	Teaching activities	Notes
21			CROSS TOPIC REVIEW Page 541-543

Week	Statements	Teaching activities	Notes
22			CROSS TOPIC REVIEW Page 541-543

Week	Statements	Teaching activities	Notes
23			

Week	Statements	Teaching activities	Notes
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Week	Statements	Teaching activities	Notes
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