Paper 1
REVISION NOTES

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Uniform acceleration

- One dimension – no acceleration
  distance = speed × time
- One dimension – uniform acceleration

$\mathbf{v = u + at}$

$\mathbf{s = ut + \frac{1}{2}at^2}$

$\mathbf{v^2 = u^2 + 2as}$

$\mathbf{s = \frac{1}{2}(v+u)t}$

$\mathbf{s = vt - \frac{1}{2}at^2}$

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Motion graphs

- Gradient of displacement time graph is velocity. (ms^{-1})
- Area under velocity time graph is displacement.
- Gradient of velocity time graph is acceleration. (ms^{-2})
- Stroboscope photos, light gates etc

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Projectiles

- Horizontal and vertical velocities are independent.
- Vertical motion is that of gravity.
- Horizontal motion is constant assuming no friction or air resistance.
- Vertical component $v_y = v\sin\theta$
- Horizontal component $v_x = v\cos\theta$
  (where θ is between launch and ground)

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Scalars and Vectors

- Scalar – magnitude only
  - distance, speed, work etc
- Vector – magnitude and direction
  - displacement, velocity, force etc
- Resolution $v_y = v\sin\theta$ $v_x = v\cos\theta$
  (θ between vector and horizontal)
- Combination
  - Pythagoras triangle
  - Vector triangle (polygon) – scale drawing

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Moments and stability

- Moment = Force × perpendicular distance
  Units N.m
- Principle of Moments:-
  Clockwise moments = Anticlockwise moments
- Centre of mass – the point through which all of the mass appears to act. (C of G)
- Static and stable when:-
  - Σhorizontal forces = 0
  - Σvertical forces = 0
  - Σclockwise moments = Σanticlockwise moments

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Newton's Laws of Motion

- Law 1. Acceleration = 0
  - Every body continues in its present state of rest or uniform motion in a straight line unless acted upon by a resultant force.
- Law 2. $\sum F = m.a$
  - The rate of change of momentum is proportional to the applied force and takes place in the direction of that force.
- Law 3. Conservation of momentum.
  - To every reaction there is an equal and opposite reaction

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Momentum

- momentum = mass × velocity
  $p = mv$ N.s
- Conservation of momentum
  momentum before = momentum after
- Impulse = Force × $\Delta t = \Delta mv$ (Newton 2)
- Newton 3 - Forces:-
  act on different bodies
  same magnitude
  act in opposite directions
  are the same type

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Mass and Weight

- ‘Mass is what you buy – weight is what you carry home.’
- Gravitational field strength, g.
- g = F/m $N.kg^{-1}$
- W = mg
- g = acceleration due to gravity
- g = $9.81 m.s^{-2}$

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Work and Energy

- Energy is the capacity to do work. Joules.
- Work done = force ×distance moved in the direction of the force.
- W = F.s.cosθ
- Gravitational potential energy

  the energy an object has because of its position in a gravitational field. $E_p = mg\Delta h$
- Kinetic energy

  the energy an object has because of its velocity. $Ek = \frac{1}{2}mv^2$

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Power

- Power – the rate at which work is done or energy transferred.
- Power = work done/time taken Watt
- Power = energy transferred/time taken
- Power = force × velocity

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Electricity 1

- Current – rate of flow of electrons.

  $I = \Delta Q/\Delta t$ Amps
- Potential difference – the energy lost by electrons.

  V = W/Q Volts
- Series circuit – current the same, voltage shared.
- Parallel circuit – voltage the same, current shared.

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Electricity 2

- Resistors in series

  $R_T = R_1 + R_2 + ...$
- Resistors in parallel

  $1/R_T = 1/R_1 + 1/R_2 + ...$
- Ohm's Law $V = I \times R$ for ohmic conductors at constant temperature.
- I-V curves for diode, filament lamp and thermistor
  - Metals have a positive temp. coef.
  - Semiconductors have a negative temp. coef

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Electricity 3

- Power $P = V \times I = I^2 \times R = V^2/R$ Watts
- Energy = Power × time = $V \times I \times t$ Joules

$$\text{efficiency} = \frac{\text{useful energy (or power) output}}{\text{total energy (or power) input}} \times 100\%$$

- EMF – electromotive force
  - the p.d. across the terminals of a source of electricity when there is no load
- $E = V + I \times r$

  r is the internal resistance

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Electricity 4

- $I = n \times q \times v \times A$
- Free electron theory of metals
  - Conduction electrons
- Semiconductor impurities
  - Provides charge carriers
- $R = \rho l/A$
  - resistivity ohm.metres
- Potential divider

$$V_{out} = \frac{V_{in} \times R_2}{R_1 + R_2}$$

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Prefixes

• tera	×1,000,000,000,000	(T)	TeV
• giga	×1,000,000,000	(G)	GeV
• mega	×1,000,000	(M)	MHz, M
• kilo	×1,000	(k)	kHz, k, kV
• milli	×0.001	(m)	mV, mA, mW
• micro	×0.000 001	(μ)	μV, μA, μW, μF
• nano	×0.000 000 001	(n)	nF
• pico	×0.000 000 000 001	(p)	pF

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Questions

- Set in context – read the context – underline relevant details.
- Look carefully at diagrams – circle and name relevant details.
- Focus on relevant bookwork descriptions and calculations – answer these.
- Attempt all sections – no credit can be given if there is no attempt at an answer!!!!!!!!
- *Estimate*, *Calculate* – show your working.
- *State and explain* – do both!

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