SYDNEY GRAMMAR SCHOOL

TRIAL EXAMINATION 2023

FORM VI PHYSICS

Candidate No:

General Instructions

- Working Time: 3 hours (+ 5min Reading Time)
- Write using black pen

Structure of Paper & Instructions

- Section I Multiple Choice (20 marks).
  Spend 30 minutes on this section.
- Section II Parts A-D (80 marks).
  Spend 2 hours and 30 minutes on this section.

Total marks: 100

Wednesday 16 August 8:40am

Checklist

Each boy should have the following:

- ☐ Examination Paper (includes)
  - Examination sections
  - Extra Writing sheets
  - Data/Formula sheets
  - Multiple-Choice Answer Sheet

AAH, SRW, PCK, ILM MIC: PCK

Exam Instructions

- Remove the centre staple and hand in all parts of the examination in a neat bundle in its original order. Do not insert parts into other parts.
- WRITE YOUR **CANDIDATE NUMBER** IN THE SPACE PROVIDED AT THE TOP OF EACH SEPARATED PART OF THE PAPER.
- Responses requiring more writing space than provided should clearly be marked **CONTINUED**. When the response is continued on extra writing paper it should clearly indicate the question number.
  - Each detachable part A-D of Section II has additional writing space to use for that part.
  - Further additional writing paper can be given on request.

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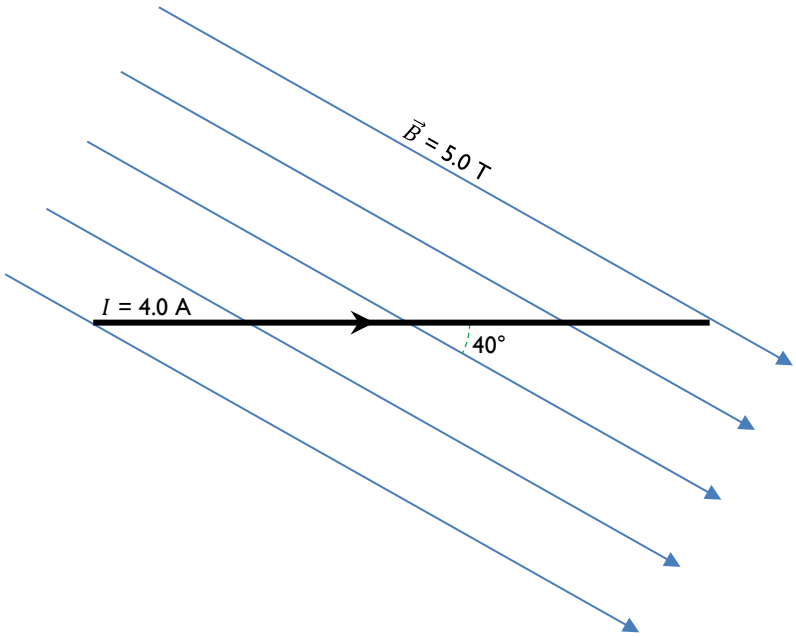
SECTION I: MULTIPLE CHOICE (20 marks)

Attempt ALL Questions
Use the Multiple-Choice Answer Sheet.

1 A wire of length 2.0 metres and carrying a current of 4.0 A to the right is placed in a uniform magnetic field of magnitude 5.0 T as shown below.



The magnitude of the force on the wire is:

(A) 0 N

(B) 26 N

(C) 31 N

(D) 40 N

2 Why are the iron cores of transformers laminated?

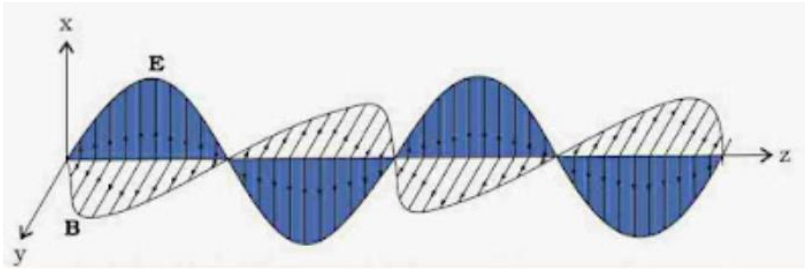
(A) To reduce eddy currents.

(B) To reduce heat loss in the coils.

(C) To increase magnetic flux linkage.

(D) To improve electrical connection between primary and secondary coils.

3 The diagram below shows an electromagnetic wave.



Which of the statements is correct?

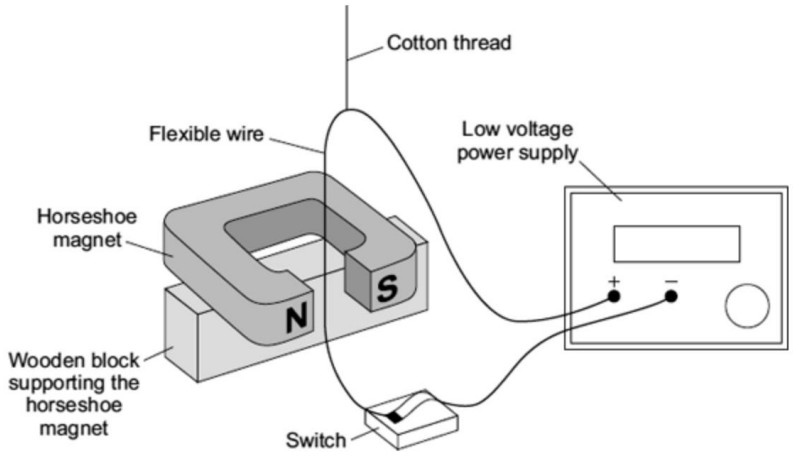
(A) The wave could be travelling along the x-axis.

(B) The wave could be travelling along the y-axis.

(C) The wave could have been created by an oscillating charge.

(D) The wave could have been created by a stationary charge.

4 A flexible wire is connected to a powerpack and switch and placed in a magnetic field as shown below.



When the switch is closed, which way does the wire move?

(A) Into the magnet.

(B) Away from the magnet.

(C) Towards the South pole

(D) Towards the North Pole

5 A DC motor is connected to a 6 V power supply. When the motor is at its normal operating speed, the current through the coil is 2.4 A. When the motor is momentarily held still, the current rises to 12 A.

The back emf in the coil at its normal operating speed is:

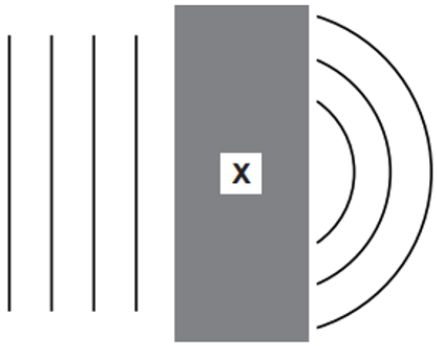
(A) 0.5 V

(B) 1.2 V

(C) 2.4 V

(D) 4.8 V

6 The diagram below shows light with plane wavefronts incident upon a region X that is hidden from view.



Region X is most likely to contain:

(A) A single narrow slit.

(B) Two narrow slits.

(C) A diffraction grating.

(D) A polarising filter.

7 A student looked at their computer screen through a polarising filter. They observed that as they rotated the filter, the brightness of the light changed.

Which property of the light from the screen is displayed?

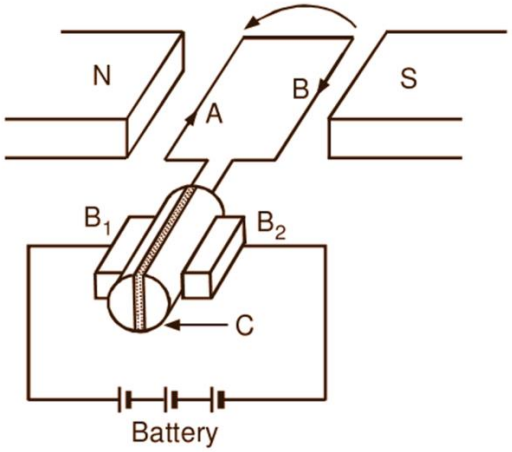
(A) The light is quantised.

(B) The light is unpolarised.

(C) The light is a transverse wave.

(D) The light is a longitudinal wave.

8 A simple DC motor is shown below.



Which of the following statements is true about the force on side A and the torque produced in the coil as it rotates 30° from the position shown?

	Force on Side A	Torque in Coil
(A)	Constant in magnitude	Constant in magnitude
(B)	Constant in magnitude	Changing in magnitude
(C)	Changing in magnitude	Constant in magnitude
(D)	Changing in magnitude	Changing in magnitude

9 Outside of the solar system, the closet planet to Earth is believed to be the exoplanet Proxima Centauri d. It has a mass of 0.26 times the mass of the Earth, and a radius of 0.81 times the Earth's radius.

Calculate the gravitational field strength at the surface of Proxima Centauri d.

(A) 2.5 $m\,s^{-2}$

(B) 3.1 $m\,s^{-2}$

(C) 3.9 $m\,s^{-2}$

(D) 25 $m\,s^{-2}$

10 A spinning disc with a radius of 0.20 m takes 0.25 s to complete one revolution.

Calculate its angular velocity.

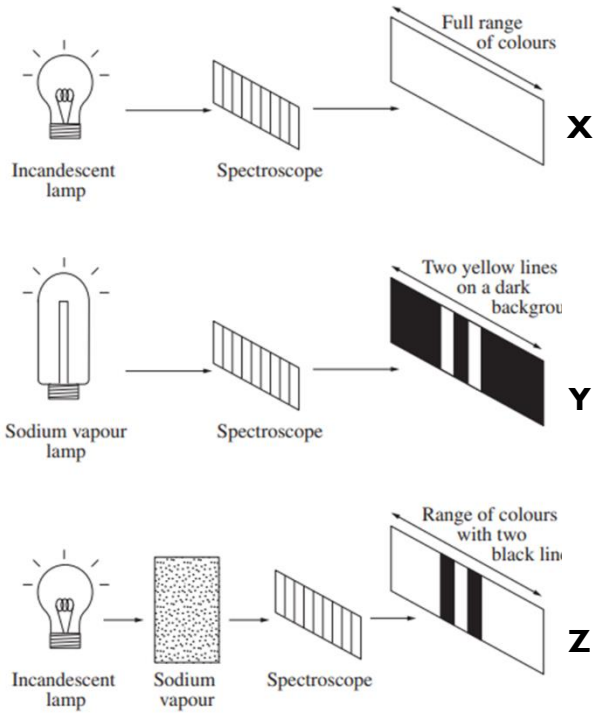
(A) 0.80 $rad\,s^{-1}$

(B) 4.0 $rad\,s^{-1}$

(C) 5.0 $rad\,s^{-1}$

(D) 25 $rad\,s^{-1}$

11 Which of the following spectra would be most representative of the spectrum measured from a star?



(A) Spectrum X.

(B) Spectrum Y.

(C) Spectrum Z.

(D) Spectra Y and Z.

12 A 2 C charge is placed in a uniform electric field E = 200 N C^{-1}. How much work is done by the electric field on the charge when it moves 0.10 m parallel to the field?

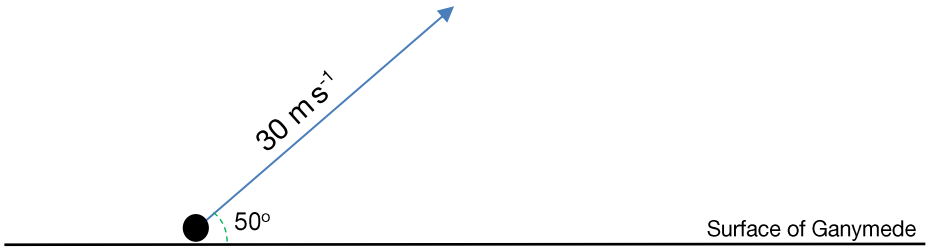
(A) 40 J

(B) 100 J

(C) 400 J

(D) 4000 J

13 A probe on Jupiter's moon Ganymede launches a rock at a speed of 30 $m\,s^{-1}$ at an angle of 50° to the horizontal, as shown in the diagram below. The rock takes 32 s to hit the ground.



Calculate the acceleration due to gravity on the surface of Ganymede.

(A) 0.72 $m\,s^{-2}$

(B) 0.94 $m\,s^{-2}$

(C) 1.2 $m\,s^{-2}$

(D) 1.4 $m\,s^{-2}$

14 A charge of mass 5.0×10^{-3} kg is placed between two parallel plates producing a uniform electric field of 100 $N\,C^{-1}$. The acceleration of the charge is 4.0×10^{4} $m\,s^{-2}$. The magnitude of the charge is:

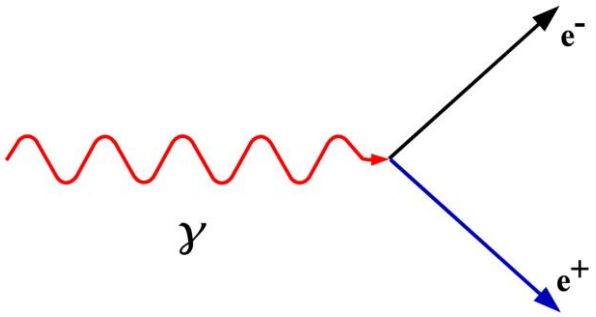
(A) 0.5 C

(B) 1 C

(C) 2 C

(D) 4 C

15 A gamma ray photon is converted into an electron and a positron (which has the same mass as an electron.)



What was the energy of the gamma ray photon?

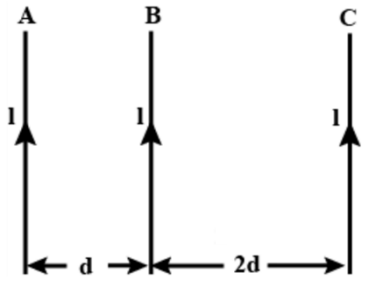
(A) 2.7×10^{-22} J

(B) 5.5×10^{-22} J

(C) 8.2×10^{-14} J

(D) 1.6×10^{-13} J

16 Three parallel wires carry equal current I, as shown below. Wire C is twice as far away as Wire A from Wire B. The resulting magnitude of net force on Wire B is F.



If the current in Wire C is then increased to $4I$, the new magnitude of the net force on wire B will be:

(A) 0

(B) F

(C) $2F$

(D) $4F$

17 If a photon with a wavelength of 414 nm hits a metal and an electron with 2.3 eV of kinetic energy is released, then determine the work function of the metal.

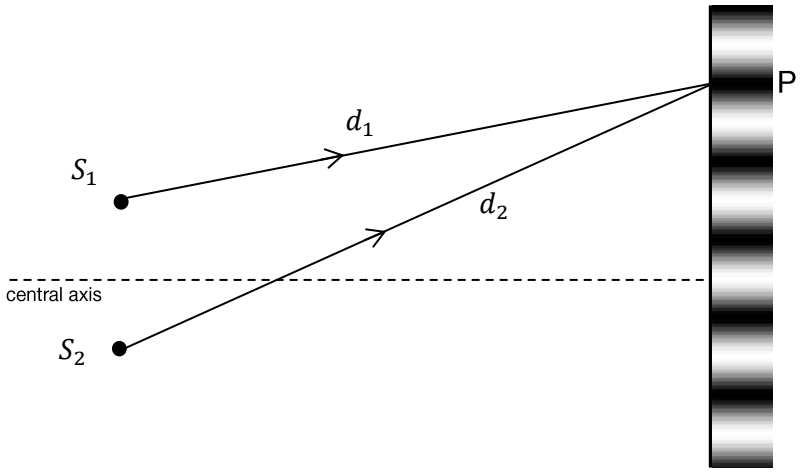
(A) 0.4 eV

(B) 0.7 eV

(C) 2.5 eV

(D) 3.0 eV

18 Light of wavelength λ passes through slit S_1 and travels a distance d_1 to reach point P. Light from the same source passes through slit S_2 and travels a distance d_2 before reaching P.



Which equation would represent the condition needed for P to be the 3rd **minimum** from the central axis?

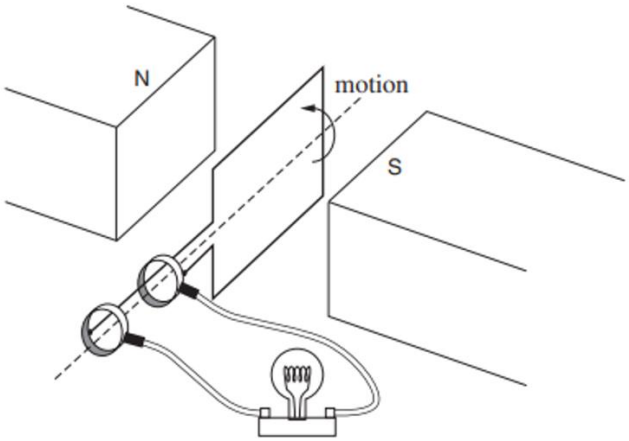
(A) $2|d_1 - d_2| = 3\lambda$

(B) $2|d_1 - d_2| = 5\lambda$

(C) $|d_1 - d_2| = 3\lambda$

(D) $|d_1 - d_2| = 5\lambda$

19 A coil of wire in a uniform magnetic field is connected to a light globe, as shown. The coil is attached to a hand crank to make it rotate.



Which of the following describes the brightness of the globe as the coil makes one full rotation from the position shown?

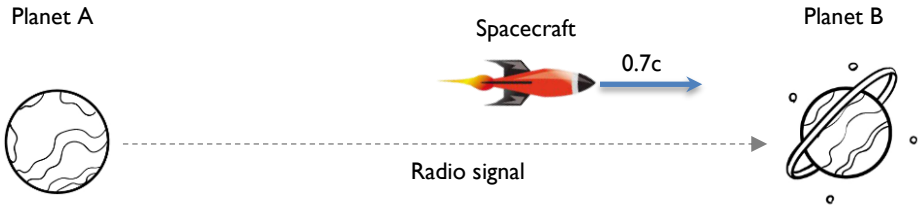
(A) Maximum → minimum → maximum

(B) Minimum → maximum → minimum

(C) Maximum → minimum → maximum→ minimum → maximum

(D) Minimum → maximum → minimum→ maximum → minimum

20 A radio message is sent from planet A to planet B informing them that a spacecraft has just left, travelling at 0.7c. The radio message is received on planet B 20 years later according to observers on planet A and B.



At the time the signal is received on planet B, how much distance will the people on the spacecraft have left to travel to planet B from their perspective?

(A) 4.3 light-years

(B) 6.0 light-years

(C) 10 light-years

(D) 14 light-years

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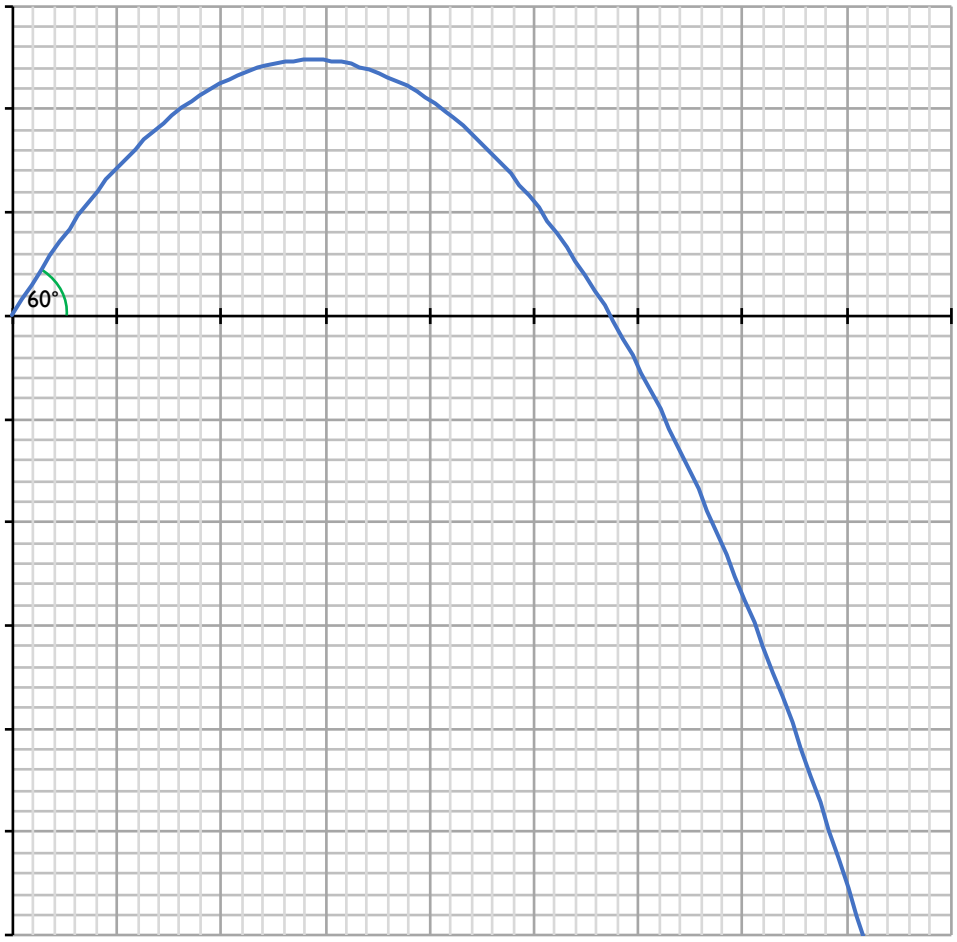
SECTION II: Part A (25 Marks)

CANDIDATE NUMBER							

Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 21 (9 marks) **Marks**

The diagram below shows the path of a projectile launched off the top of a cliff 30 m high at an angle of 60° to the horizontal.



Using the diagram, determine:

(a) The maximum height reached by the projectile, above the top of the cliff.

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Question 21 continued on next page.

Question 21 continued **Marks**

(b) The initial vertical velocity of the projectile.

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(c) The time of flight of the projectile.

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(d) The magnitude of the velocity at which the projectile hits the ground.

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Question 22 (7 marks) **Marks**

The table below lists some of the properties of the planet Mercury:

Property	Mercury	Sun
Mass (kg)	3.30×10^{23}	2.0×10^{30} kg
Rotational Period (s) (i.e., on its axis)	5.07×10^{6}	-
Orbital Radius (m)	5.79×10^{10}	-

Use the data in the table above to answer the following questions:

(a) Calculate the gravitational force of the Sun on Mercury

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(b) Calculate the orbital velocity of Mercury.

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(c) Calculate the orbital radius of a satellite that remains above the same point on the surface of Mercury (i.e., in the equivalent of a geostationary orbit around Mercury).

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Question 23 (4 marks) **Marks**

The planet Mars has a radius of 3.40×10^6 m and a mass of 6.42×10^{23} kg. A satellite of mass 1200 kg orbits Mars in a circular orbit of radius 1.40×10^7 m.

(a) Calculate the escape velocity at the surface of Mars.

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(b) Calculate the gravitational potential energy of the satellite in its orbit.

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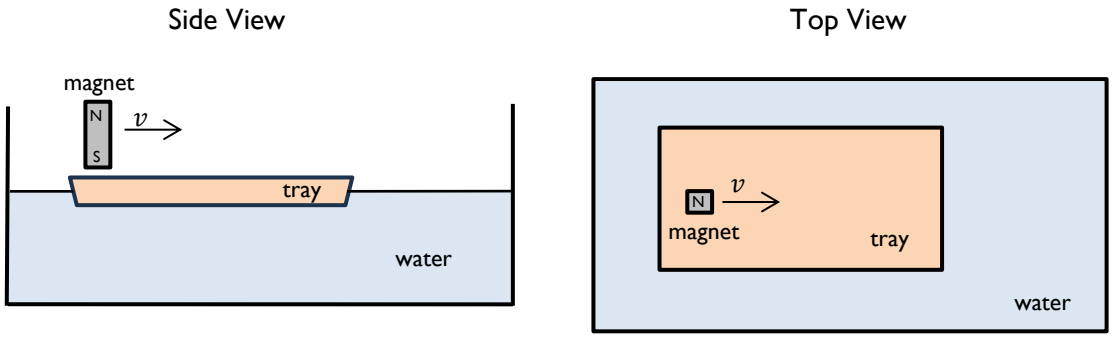
Question 24 (5 marks) **Marks**

In an experiment, students put a rectangular aluminium tray into a tub of water and hold a magnet above it, close but not touching. Then they move the magnet horizontally, as shown.



Explain the subsequent motion of the tray and compare it to the operation of an induction motor.

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Part A extra writing space

If you use this space, clearly indicate which question you are answering.

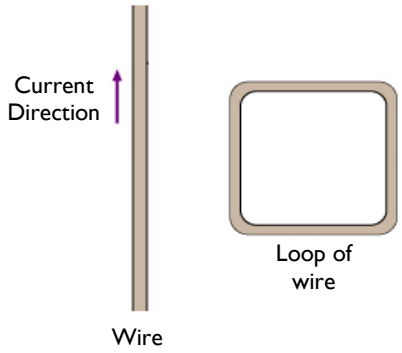
SECTION II: Part B (20 Marks)

CANDIDATE NUMBER							

Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 25 (2 marks) **Marks**

A current carrying wire is placed next to a square loop of wire as shown below.



The current in the wire is increased at a steady rate.

(a) Identify the direction of current flow in the square loop (clockwise or counterclockwise or zero).

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(b) Identify the direction of the net force on the loop of wire.

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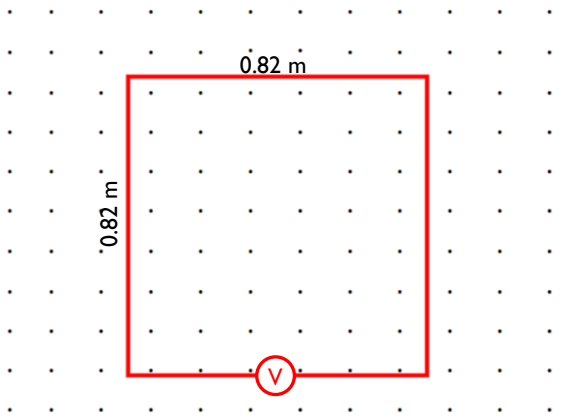
Question 26 (2 marks) **Marks**

A square coil with 0.82 m sides with a voltage is in a uniform magnetic field that is initially $B = 6.0 \times 10^{-3}$ T.



If the field is reduced uniformly to zero over a time of 0.25 s, determine the magnitude of the voltage that would be measured during this time.

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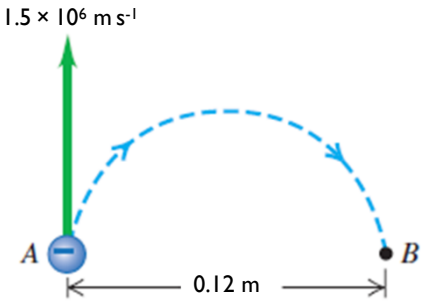
Question 27 (2 marks) **Marks**

An electron at point A has a speed of $1.5 \times 10^6\ \text{m s}^{-1}$.



Determine the magnitude and direction of the magnetic field that will cause the electron to follow the semi-circular path from A to B.

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Question 28 (4 marks) **Marks**

A transmission line is used to transmit power from a power station to a town. The power station produces 6.0 MW at a voltage of 3 kV.

An ideal transformer is used to boost the voltage from 3 kV to 600 kV.

(a) What is the ratio of the number of coils in the primary to the secondary in the transformer?

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(b) Determine the current in the primary coil of the transformer.

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(c) Outline the advantage of using a step-up transformer between the power station and the transmission line.

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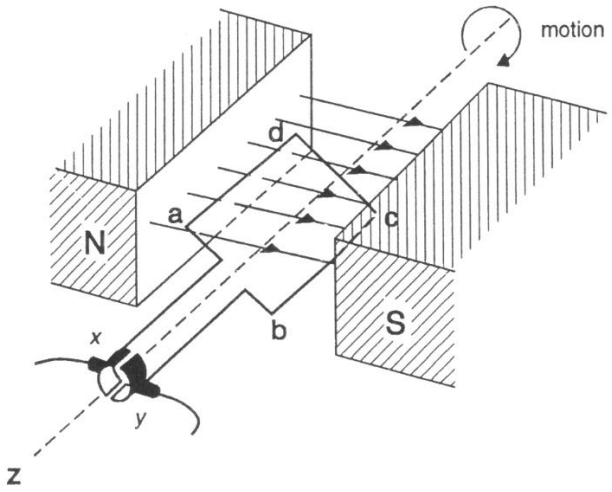
Question 29 (4 marks) **Marks**

A single loop of coil with sides ad = 0.12 m and cd = 0.080 m is in a magnetic field of B = 0.20 T. A current of 5.6 A runs through the coil.



(a) Determine the magnitude of the maximum force on wire ad.

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(b) Determine the magnitude of the maximum torque produced in the coil.

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(c) Which of x and y should be connected to the positive terminal of the battery for the coil to rotate clockwise as shown?

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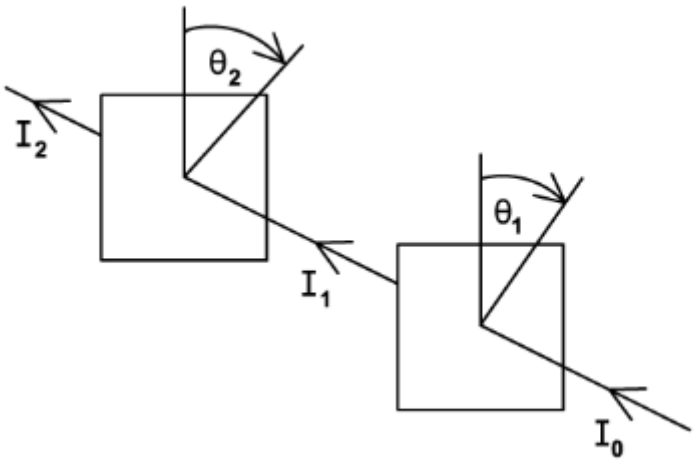
Question 30 (3 marks) **Marks**

Unpolarised light of intensity I_0 is incident on the first of two polarising sheets, seen below.



If θ_2 is set to 56° and I_2 has an intensity that is 0.20 I_0, determine a possible value for the angle θ_1.

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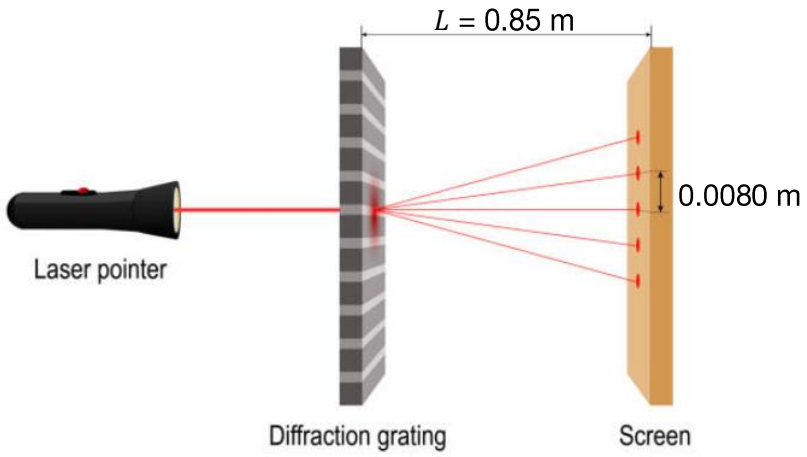
Question 31 (3 marks) **Marks**

Light from a laser pointer passes through a diffraction grating with a split spacing of 7.0×10^{-5} m and is then incident upon a screen, as shown. The distance between the grating and the screen is $L = 0.85$ m and the spacing between the bright spots is 0.0080 m.



(a) Determine the wavelength of the laser pointer.

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(b) If the laser pointer was replaced by one with a wavelength of 520 nm, what new value of L would lead to the bright spots being the same distance apart?

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Part B extra writing space

If you use this space, clearly indicate which question you are answering.

SECTION II: Part C (15 Marks)

CANDIDATE NUMBER							

Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 32 (3 marks) **Marks**

Muons at rest have an average lifetime of 2.2 μs. Special Relativity predicted that when they are moving fast relative to an observer this lifetime will be different.

Explain how muons were used as evidence for Einstein's Special Theory of Relativity.

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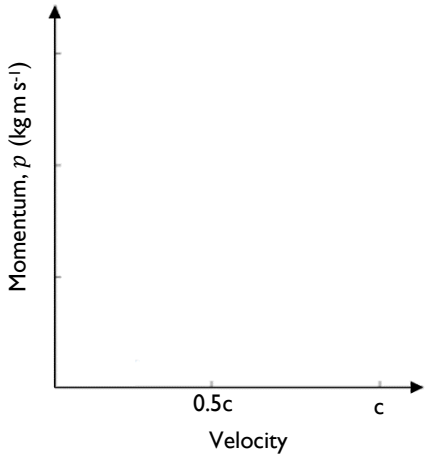
Question 33 (3 marks) **Marks**

A constant force, F, applied to an object over a fixed period of time, t, (i.e., an impulse, I) increases the object's momentum and velocity.

$$I = \Delta p$$

(a) Sketch on the axes below how the relativistic momentum of the object would change as it's velocity increases.



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(b) If the impulse needed to increase the velocity of the object from rest to 0.5c is I_o then explain why applying the same impulse I_0 again to the object (i.e., same Δp) will not increase its speed from 0.5c to c.

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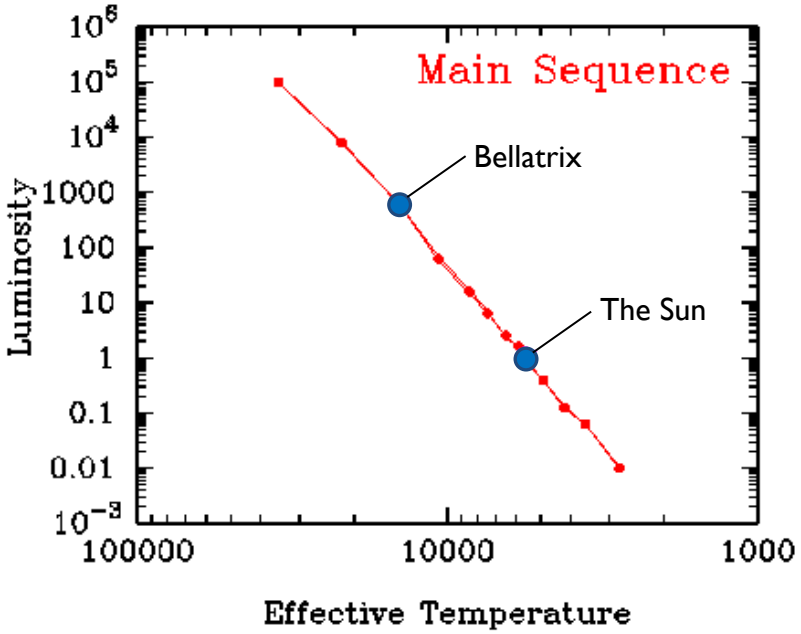
Question 34 (4 marks) **Marks**

Depicted below is a Hertzsprung-Russell diagram with two stars on the main sequence, our Sun and Bellatrix.



Compare the similar and different properties of these two stars.

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Question 35 (5 marks) **Marks**

Explain how the classical electromagnetic theory's failure to account for the photoelectric effect and the blackbody radiation spectrum led to a quantum model of light.

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Part C extra writing space

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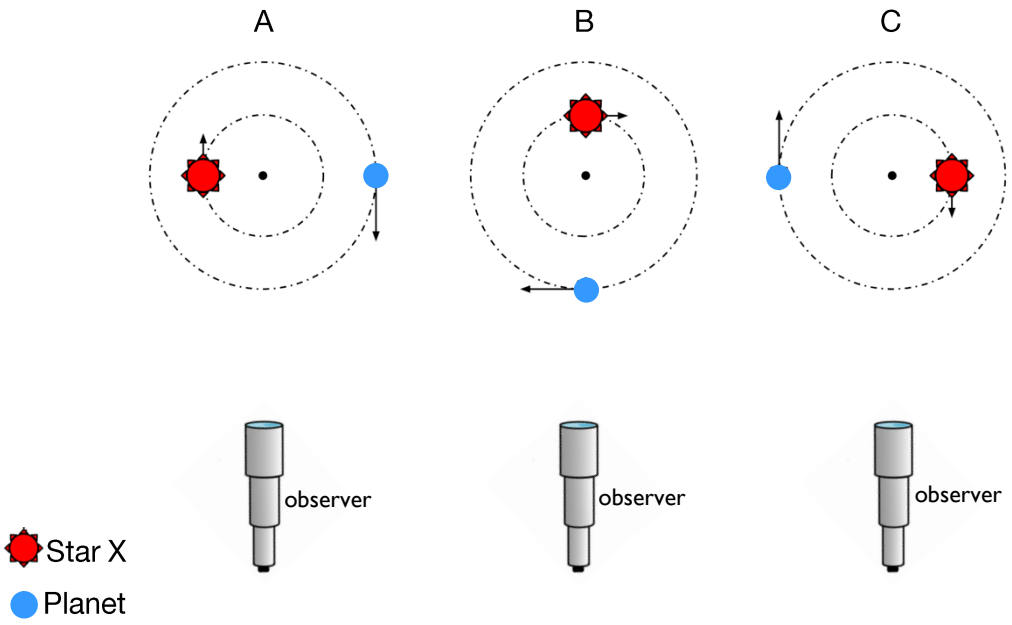
SECTION II: Part D (20 Marks)

CANDIDATE NUMBER							

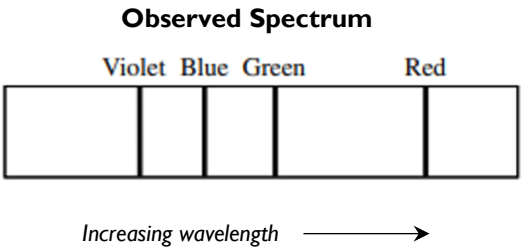
Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 36 (5 marks) **Marks**

In a distant star system, a red star X and a planet orbit each other as shown below. The spectrum of the visible star when it is in position A is shown.



(a) Draw new lines on the spectrum below to indicate possible positions of the lines when the star is in position C.



Justify your reasoning.

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Question 36 continued on next page.

Question 36 continued **Marks**

(b) Explain how the spectral lines would be different if Star X was also spinning on its axis.

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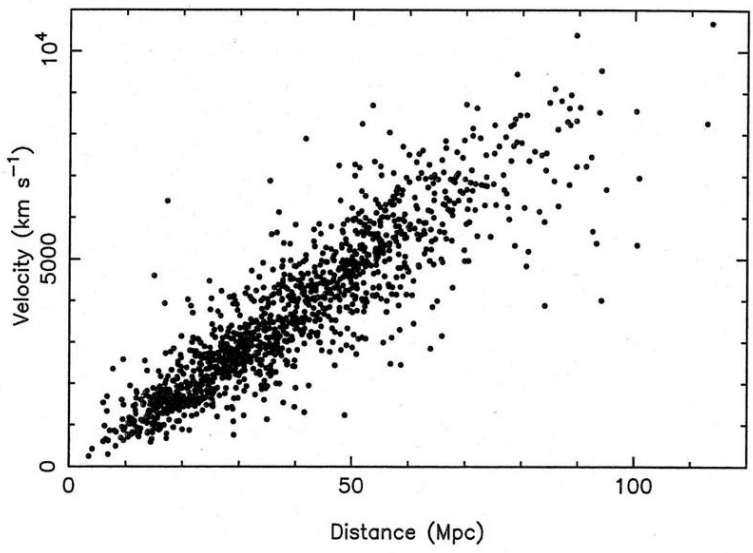
Question 37 (6 marks) **Marks**

Below is a graph of recessional velocity versus estimated distance for a set of 1355 galaxies.



(a) Outline how the light from these galaxies was used to determine the velocities in the graph.

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(b) Explain how this graph provides evidence for the Big Bang theory.

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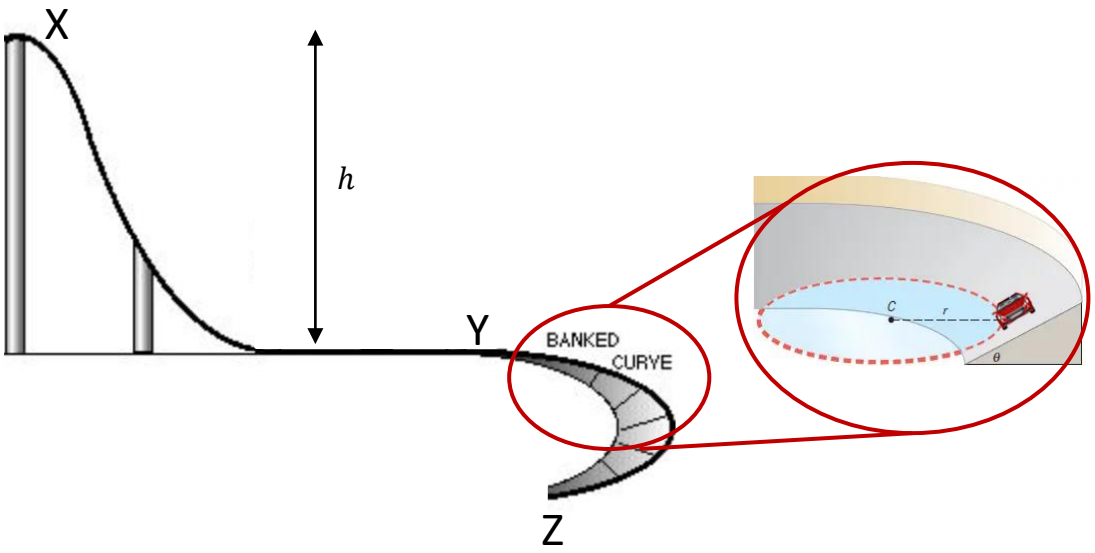
Question 38 (9 marks) **Marks**

A toy car of mass 0.25 kg rolls from rest at position X down a smooth slope, dropping a vertical height of 0.30 m, before undergoing horizontal circular motion around a track from position Y to Z that is banked at angle θ with a radius of r = 0.40 m.



Analyse the energy changes and forces acting on the car as it moves from X to Z and calculate the angle θ that would allow the car to go around the banked section without any friction force acting.

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Question 38 continued on next page.

Question 38 continued **Marks**

9

END OF EXAMINATION

Part D extra writing space

If you use this space, clearly indicate which question you are answering.

Physics

DATA SHEET

Charge on electron, q_e	-1.602×10^{-19} C
Mass of electron, m_e	9.109×10^{-31} kg
Mass of neutron, m_n	1.675×10^{-27} kg
Mass of proton, m_p	1.673×10^{-27} kg
Speed of sound in air	$340\ \text{m s}^{-1}$
Earth's gravitational acceleration, g	$9.8\ \text{m s}^{-2}$
Speed of light, c	$3.00 \times 10^8\ \text{m s}^{-1}$
Electric permittivity constant, ε_0	$8.854 \times 10^{-12}\ \text{A}^2\,\text{s}^4\,\text{kg}^{-1}\,\text{m}^{-3}$
Magnetic permeability constant, μ_0	$4\pi \times 10^{-7}\ \text{N A}^{-2}$
Universal gravitational constant, G	$6.67 \times 10^{-11}\ \text{N m}^2\,\text{kg}^{-2}$
Mass of Earth, M_E	6.0×10^{24} kg
Radius of Earth, r_E	6.371×10^6 m
Planck constant, h	6.626×10^{-34} J s
Rydberg constant, R (hydrogen)	$1.097 \times 10^7\ \text{m}^{-1}$
Atomic mass unit, u	1.661×10^{-27} kg 931.5 MeV/c^2
1 eV	1.602×10^{-19} J
Density of water, ρ	$1.00 \times 10^3\ \text{kg m}^{-3}$
Specific heat capacity of water	$4.18 \times 10^3\ \text{J kg}^{-1}\,\text{K}^{-1}$
Wein's displacement constant, b	$2.898 \times 10^{-3}\ \text{m K}$

FORMULAE SHEET

Motion, forces and gravity

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

$$v^2 = u^2 + 2as$$

$$\Delta U = mg\Delta h$$

$$P = \frac{\Delta E}{\Delta t}$$

$$\sum \frac{1}{2}mv^2_{\text{before}} = \sum \frac{1}{2}mv^2_{\text{after}}$$

$$\Delta \vec{p} = \vec{F}_{\text{net}}\Delta t$$

$$\omega = \frac{\Delta \theta}{t}$$

$$\tau = r_{\perp}F = rF\sin\theta$$

$$v = \frac{2\pi r}{T}$$

$$U = -\frac{GMm}{r}$$

$$v = u + at$$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$W = F_{||}s = Fs\cos\theta$$

$$K = \frac{1}{2}mv^2$$

$$P = F_{||}v = Fv\cos\theta$$

$$\sum m\vec{v}_{\text{before}} = \sum m\vec{v}_{\text{after}}$$

$$a_{\text{c}} = \frac{v^2}{r}$$

$$F_{\text{c}} = \frac{mv^2}{r}$$

$$F = \frac{GMm}{r^2}$$

$$\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$$

Waves and thermodynamics

$$v = f\lambda$$

$$f = \frac{1}{T}$$

$$d\sin\theta = m\lambda$$

$$n_{\text{x}} = \frac{c}{v_{\text{x}}}$$

$$I = I_{\text{max}}\cos^2\theta$$

$$Q = mc\Delta T$$

$$f_{\text{beat}} = \left| f_2 - f_1 \right|$$

$$f' = f\frac{\left(v_{\text{wave}} + v_{\text{observer}}\right)}{\left(v_{\text{wave}} - v_{\text{source}}\right)}$$

$$n_1\sin\theta_1 = n_2\sin\theta_2$$

$$\sin\theta_{\text{c}} = \frac{n_2}{n_1}$$

$$I_1r_1^2 = I_2r_2^2$$

$$\frac{Q}{t} = \frac{kA\Delta T}{d}$$

Electricity and magnetism

$$E = \frac{V}{d}$$

$$V = \frac{\Delta U}{q}$$

$$W = qV$$

$$W = qEd$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$B = \frac{\mu_0 NI}{L}$$

$$\Phi = B_{||}A = BA\cos\theta$$

$$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$$

$$\frac{V_\mathrm{p}}{V_\mathrm{s}} = \frac{N_\mathrm{p}}{N_\mathrm{s}}$$

$$\vec{F} = q\vec{E}$$

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$$

$$I = \frac{q}{t}$$

$$V = IR$$

$$F = qv_\perp B = qvB\sin\theta$$

$$F = lI_\perp B = lIB\sin\theta$$

$$\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{I_1 I_2}{r}$$

$$\tau = nIA_\perp B = nIAB\sin\theta$$

$$V_\mathrm{p} I_\mathrm{p} = V_\mathrm{s} I_\mathrm{s}$$

Quantum, special relativity and nuclear

$$\lambda = \frac{h}{mv}$$

$$K_\mathrm{max} = hf - \phi$$

$$\lambda_\mathrm{max} = \frac{b}{T}$$

$$E = mc^2$$

$$E = hf$$

$$\frac{1}{\lambda} = R\left(\frac{1}{n_\mathrm{f}^2} - \frac{1}{n_\mathrm{i}^2}\right)$$

$$t = \frac{t_0}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}$$

$$l = l_0\sqrt{\left(1 - \frac{v^2}{c^2}\right)}$$

$$p_\mathrm{v} = \frac{m_0 v}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}$$

$$N_\mathrm{t} = N_0 e^{-\lambda t}$$

$$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$$

PERIODIC TABLE OF THE ELEMENTS

1 H 1.008 Hydrogen																	2 He 4.003 Helium
3 Li 6.941 Lithium	4 Be 9.012 Beryllium											5 B 10.81 Boron	6 C 12.01 Carbon	7 N 14.01 Nitrogen	8 O 16.00 Oxygen	9 F 19.00 Fluorine	10 Ne 20.18 Neon
11 Na 22.99 Sodium	12 Mg 24.31 Magnesium											13 Al 26.98 Aluminium	14 Si 28.09 Silicon	15 P 30.97 Phosphorus	16 S 32.07 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.95 Argon
19 K 39.10 Potassium	20 Ca 40.08 Calcium	21 Sc 44.96 Scandium	22 Ti 47.87 Titanium	23 V 50.94 Vanadium	24 Cr 52.00 Chromium	25 Mn 54.94 Manganese	26 Fe 55.85 Iron	27 Co 58.93 Cobalt	28 Ni 58.69 Nickel	29 Cu 63.55 Copper	30 Zn 65.38 Zinc	31 Ga 69.72 Gallium	32 Ge 72.64 Germanium	33 As 74.92 Arsenic	34 Se 78.96 Selenium	35 Br 79.90 Bromine	36 Kr 83.80 Krypton
37 Rb 85.47 Rubidium	38 Sr 87.61 Strontium	39 Y 88.91 Yttrium	40 Zr 91.22 Zirconium	41 Nb 92.91 Niobium	42 Mo 95.96 Molybdenum	43 Tc Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
55 Cs 132.9 Caesium	56 Ba 137.3 Barium	57–71 Lanthanoids	72 Hf 178.5 Hafnium	73 Ta 180.9 Tantalum	74 W 183.9 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.1 Platinum	79 Au 197.0 Gold	80 Hg 200.6 Mercury	81 Tl 204.4 Thallium	82 Pb 207.2 Lead	83 Bi 209.0 Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89–103 Actinoids	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson

KEY

Atomic Number	79
Symbol	Au
Standard Atomic Weight	197.0
Name	Gold

Lanthanoids

57 La 138.9 Lanthanum	58 Ce 140.1 Cerium	59 Pr 140.9 Praseodymium	60 Nd 144.2 Neodymium	61 Pm Promethium	62 Sm 150.4 Samarium	63 Eu 152.0 Europium	64 Gd 157.3 Gadolinium	65 Tb 158.9 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.9 Holmium	68 Er 167.3 Erbium	69 Tm 168.9 Thulium	70 Yb 173.1 Ytterbium	71 Lu 175.0 Lutetium

Actinoids

89 Ac Actinium	90 Th 232.0 Thorium	91 Pa 231.0 Protactinium	92 U 238.0 Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

Standard atomic weights are abridged to four significant figures.

Elements with no reported values in the table have no stable nuclides.

Information on elements with atomic numbers 113 and above is sourced from the International Union of Pure and Applied Chemistry Periodic Table of the Elements (November 2016 version).

The International Union of Pure and Applied Chemistry Periodic Table of the Elements (February 2010 version) is the principal source of all other data. Some data may have been modified.

SYDNEY GRAMMAR SCHOOL

CANDIDATE NUMBER

2023
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Physics

Section I - Multiple Choice

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

correct

A ⊗ B ⊗ C ○ D ○

1.	A○	B○	C○	D○		**11.**	A○	B○	C○	D○
2.	A○	B○	C○	D○		**12.**	A○	B○	C○	D○
3.	A○	B○	C○	D○		**13.**	A○	B○	C○	D○
4.	A○	B○	C○	D○		**14.**	A○	B○	C○	D○
5.	A○	B○	C○	D○		**15.**	A○	B○	C○	D○
6.	A○	B○	C○	D○		**16.**	A○	B○	C○	D○
7.	A○	B○	C○	D○		**17.**	A○	B○	C○	D○
8.	A○	B○	C○	D○		**18.**	A○	B○	C○	D○
9.	A○	B○	C○	D○		**19.**	A○	B○	C○	D○
10.	A○	B○	C○	D○		**20.**	A○	B○	C○	D○