

PHYSICS 2 UNIT -TRIAL HSC

PART A

1 B	2 A	3 A	4 B	5 D	6 C	7 B	8 B	9 A	10 D
11 C	12 A	13 C	14 D	15 D					

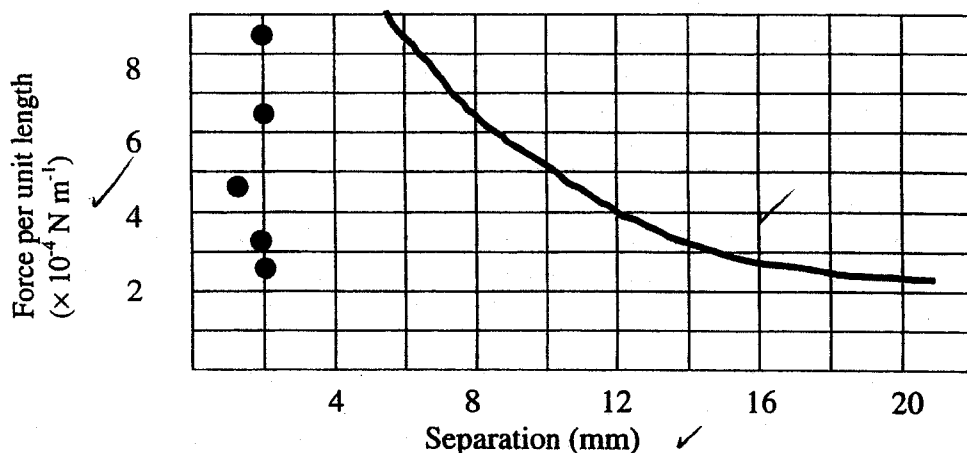
PART B

16. (a) Any suitable experimental method or computer simulation that *shows* that the vertical component of projectile motion has constant acceleration.
- (b)(i) Description of the equipment, preferably with a diagram, including two paths at right angles for initially coherent light rays, reflections and recombination of the rays to produce an interference pattern that did not alter when the apparatus was rotated through 90° implying that there was no 'aether wind'.
- (ii) Einstein's Special Theory of Relativity postulates that the velocity of light is the same for all observers. Hence, whether or not there is an aether, time dilation or length contraction will explain why the experiment must have a null result.
17. (a) Faraday. ①
- (b) ② Diagram for motor should show at least permanent magnets or field coils, rotating coil, power supply source and labels; description should include creation of the rotating coil's magnetic field ① and its interaction with the magnetic field surrounding it causing rotation.
Diagram for generator should show at least permanent magnets, rotating coil and a load or output terminals; description should include induction of emf in the rotating coil causing a current to be ① supplied to the load or voltage to the output terminals. (A suitable similar description of induction in stator coils should gain full marks.)
- (c) Suitable explanatory diagram and appropriate description linking the motion of the device to the motor effect. ① *Torque on coil* ①
18. (a) gamma rays are much more penetrating than electrons (more energy); electrons are charged, gamma rays are not.
- (b) $E = hf \Rightarrow E = hc/\lambda = 6.626 \times 10^{-34} \times 3 \times 10^8 \div 4 \times 10^{-11} = 4.97 \times 10^{-15}$ ①
19. Three of: Earth's shape (equatorial diameter greater than polar diameter); Earth's spin (greatest effect at the equator, none at the poles); variations in the lithosphere (thickness, density etc); distance from the surface (or Earth's centre as distinct from the first point).
20. Light consists of photons with specific energy ($E = hf$). To emit a photoelectron, a minimum energy is required, so there would be no photo current below a cutoff frequency. The higher the frequency, the greater the stopping voltage. The photo current would be more difficult to reduce to zero since electrons would have greater amounts of KE ($\frac{1}{2}mv^2 = hf - \phi$ where ϕ is the energy required to get the electron out of the material). Explanations that relate lower anode voltages to higher frequency for a photocurrent should gain full marks. ① *Effect of "f" on current* (1). *↑; KE ↑ but photocurrent is not changed* ①
21. (a) $V_P V_S = N_P N_S \Rightarrow V_S = 240 \times 5 \div 800 = 1.5$ V
- (b) At 100% efficiency, power input = power output: $V_P I_P = V_S I_S \Rightarrow 1.5 I_S = 240 I_P \therefore I_S = 160 I_P$ and so a small primary current will produce a very large secondary current, sufficient to weld together two nails.
- (c) The laminations are thin sheets of soft iron insulated from each other. The plane of the laminations is normal to induced eddy currents and so these are significantly reduced, and hence energy losses as heat are reduced.
22. (a) Disc tries to rotate in the same direction as the turntable. ①
- (b) The changing magnetic field of the rotating horseshoe magnet induces a current in the aluminium disc, a conductor. The induced current is, according to Lenz's law, in such a direction as to oppose the change which caused it and its magnetic field will oppose the changing magnetic field of the horseshoe magnet, slowing it down and causing the disc to try and rotate. ①
23. Thermionic devices are bulky; consume large amounts of power with resulting heat generation; require high voltages; are fragile - the vacuum could not always be readily maintained; the coating on the heated
- Thermionic: modified cathode ray tubes ① } solid state: semiconductors ①

cathodes gradually boiled off; are fault prone. Semiconductor devices on the other hand are small, consume small amounts of power; operate on small voltages; are rugged and relatively fault free. As a result of all these aspects of the superiority of semiconductor devices, they are the preferred choice in the vast majority of electronic equipment and so replaced thermionic devices.

24. (a) The van Allen belts are 2 doughnut shaped regions around the earth containing charged particles. (1)
 (b) Increased sunspot activity results in increased flow of charged particles into the van Allen belts and their associated electric currents. (1)
 (c) Geostationary satellites are positioned near the outer edge of the van Allen belts and the increased ions in the area cause them to vary in the charge they carry. The result can be electrical failure. Communication with the satellites is also affected by increased electric currents affecting the ionosphere. (p. 72, 73)

25. (a)



- (b) As the graph shows an inverse relationship, one of the variables should be inverted and another graph drawn. If this graph is a straight line, then force per unit length is inversely proportional to separation.
26. Current rocket speeds are too slow for extended travel. It would take a great many years (10 - 100) to travel outside the solar system due to the relatively low efficiency of chemical combustion reactions. The human crew will not be able to reach another star in their lifetime or even in several generations. Communication would suffer significant degradation due to interference from the solar wind and magnetosphere, as well as signal loss from inverse square weakening. (van Allen)
27. (a) (i) When a Maltese cross discharge tube is used, a distinct shadow of the cross occurs at the end of the tube opposite to the cathode - the rays have not penetrated the cross. The cathode, edge of the cross and edge of the shadow all lie on the same straight line
 (ii) . By using a paddle wheel in a discharge tube, the wheel can be made to rotate by collision from the cathode rays - hence the rays transfer energy and do work.
- (b) Remain at least 1 m from the equipment to reduce the danger from either high voltages or soft X-rays.
28. In the superconducting state, it produces currents inside the material such that their magnetic field cancels any externally applied magnetic field. The magnetic field in the cooled superconductor is always zero - a superconductor is said to expel any magnetic field from inside it. (1) OK (1)
 The magnetic field of the internal currents will oppose the external applied magnetic field, causing repulsion. The force of repulsion can balance the gravitational force on a magnet above the superconductor so that the magnet levitates above the superconductor.



SECTION II

Q29. Geophysics

(a)(i)

Rock /material	Dry mass (g)	Volume of water displaced (cm ³)	Density gcm ⁻³
granite	45.1g	17.0	2.65
basalt	36.4	13.0	2.80
iron	28.5	3.60	7.92

- (a)(ii) Both granite and basalt make up the bulk of continental and ocean crust respectively and have a density of less than 3. If the average density is 5.5 then the core must be a lot denser and iron is a good candidate as it is denser and also found in meteorites