

Classic Poetry Series

James Clerk Maxwell
- poems -

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James Clerk Maxwell(13 June 1831 – 5 November 1879)

James Clerk Maxwell was a Scottish theoretical physicist and mathematician. His most important achievement was classical electromagnetic theory, synthesizing all previously unrelated observations, experiments and equations of electricity, magnetism and even optics into a consistent theory. His set of equations—Maxwell's equations—demonstrated that electricity, magnetism and even light are all manifestations of the same phenomenon: the electromagnetic field. From that moment on, all other classic laws or equations of these disciplines became simplified cases of Maxwell's equations. Maxwell's work in electromagnetism has been called the "second great unification in physics", after the first one carried out by Isaac Newton.

Maxwell demonstrated that electric and magnetic fields travel through space in the form of waves, and at the constant speed of light. Finally, in 1864 Maxwell wrote "A dynamical theory of the electromagnetic field", where he first proposed that light was in fact undulations in the same medium that is the cause of electric and magnetic phenomena. His work in producing a unified model of electromagnetism is considered to be one of the greatest advances in physics.

Maxwell also developed the Maxwell distribution, a statistical means of describing aspects of the kinetic theory of gases. These two discoveries helped usher in the era of modern physics, laying the foundation for future work in such fields as special relativity and quantum mechanics.

Maxwell is also known for creating the first true colour photograph in 1861 and for his foundational work on the rigidity of rod-and-joint frameworks like those in many bridges.

Maxwell is considered by many physicists to be the 19th-century scientist with the greatest influence on 20th-century physics. His contributions to the science are considered by many to be of the same magnitude as those of Isaac Newton and Albert Einstein. In the end of millennium poll, a survey of the 100 most prominent physicists saw Maxwell voted the third greatest physicist of all time, behind only Newton and Einstein. On the centennial of Maxwell's birthday, Einstein himself described Maxwell's work as the "most profound and the most fruitful that physics has experienced since the time of Newton." Einstein kept a photograph of Maxwell on his study wall, alongside pictures of Michael Faraday and Newton.

Life

Early life, 1831–39

James Clerk Maxwell was born 13 June 1831 at 14 India Street, Edinburgh, to John Clerk, an advocate, and Frances Cay. Maxwell's father was a man of comfortable means, of the Clerk family of Penicuik, Midlothian, holders of the baronetcy of Clerk of Penicuik; his brother being the 6th Baronet. James was the first cousin of notable 19th century artist Jemima Blackburn.

He had been born John Clerk, adding the surname Maxwell to his own after he inherited a country estate in Middlebie, Kirkcudbrightshire from connections to the Maxwell family, themselves members of the peerage.

Maxwell's parents did not meet and marry until they were well into their thirties, unusual for the time. Moreover, his mother was nearly 40 years old when James was born. They had had one earlier child, a daughter, Elizabeth, who died in infancy. They named their only surviving child James, a name that had sufficed not only for his grandfather, but also many of his other ancestors.

When Maxwell was young his family moved to Glenlair House, which his parents had built on the 1500 acre (6.1 km²) Middlebie estate. All indications suggest that Maxwell had maintained an unquenchable curiosity from an early age. By the age of three, everything that moved, shone, or made a noise drew the question: "what's the go o' that?". In a passage added to a letter from his father to his sister-in-law Jane Cay in 1834, his mother described this innate sense of inquisitiveness:

"He is a very happy man, and has improved much since the weather got moderate; he has great work with doors, locks, keys, etc., and "show me how it doos" is never out of his mouth. He also investigates the hidden course of streams and bell-wires, the way the water gets from the pond through the wall..."

Education, 1839–47

Recognising the potential of the young boy, his mother Frances took responsibility for James' early education, which in the Victorian era was largely the job of the woman of the house. She was however taken ill with abdominal cancer, and after an unsuccessful operation, died in December 1839 when Maxwell was only eight. James' education was then overseen by John Maxwell

and his sister-in-law Jane, both of whom played pivotal roles in the life of Maxwell. His formal schooling began unsuccessfully under the guidance of a sixteen-year-old hired tutor. Little is known about the young man John Maxwell hired to instruct his son, except that he treated the younger boy harshly, chiding him for being slow and wayward. John Maxwell dismissed the tutor in November 1841, and after considerable thought, sent James to the prestigious Edinburgh Academy. He lodged during term times at the house of his aunt Isabella. During this time his passion for drawing was encouraged by his older cousin Jemima, who was herself a talented artist.

The ten-year-old Maxwell, having been raised in isolation on his father's countryside estate, did not fit in well at school. The first year had been full, obliging him to join the second year with classmates a year his senior. His mannerisms and Galloway accent struck the other boys as rustic, and his having arrived on his first day of school wearing a pair of homemade shoes and a tunic, earned him the unkind nickname of "Daftie". Maxwell, however, never seemed to have resented the epithet, bearing it without complaint for many years. Social isolation at the Academy ended when he met Lewis Campbell and Peter Guthrie Tait, two boys of a similar age who were to become notable scholars later in life. They would remain lifetime friends.

Maxwell was fascinated by geometry at an early age, rediscovering the regular polyhedron before any formal instruction. Much of his talent however, went overlooked, and despite winning the school's scripture biography prize in his second year his academic work remained unnoticed until, at the age of 13, he won the school's mathematical medal and first prize for both English and poetry.

Maxwell wrote his first scientific paper at the age of 14. In it he described a mechanical means of drawing mathematical curves with a piece of twine, and the properties of ellipses, Cartesian ovals, and related curves with more than two foci. His work, *Oval Curves*, was presented to the Royal Society of Edinburgh by James Forbes, who was a professor of natural philosophy at Edinburgh University. Maxwell was deemed too young for the work presented. The work was not entirely original, since Descartes had also examined the properties of such multifocal curves in the seventeenth century, but Maxwell had simplified their construction.

Edinburgh University, 1847–50

Maxwell left the Academy in 1847 at the age of 16 and began attending classes at the University of Edinburgh. Having had the opportunity to attend the University of Cambridge after his first term Maxwell instead decided to complete

the full course of his undergraduate studies at Edinburgh. The academic staff of Edinburgh University included some highly regarded names, and Maxwell's first year tutors included Sir William Hamilton, who lectured him on logic and metaphysics, Philip Kelland on mathematics, and James Forbes on natural philosophy. Maxwell did not find his classes at Edinburgh University very demanding, and was therefore able to immerse himself in private study during free time at the university, and particularly when back home at Glenlair. There he would experiment with improvised chemical, electric, and magnetic apparatuses, but his chief concerns regarded the properties of polarized light. He constructed shaped blocks of gelatine, subjected them to various stresses, and with a pair of polarizing prisms given to him by the famous scientist William Nicol he would view the coloured fringes which had developed within the jelly. Through this practice Maxwell discovered photoelasticity, which is a means of determining the stress distribution within physical structures.

Maxwell contributed two papers for the Transactions of the Royal Society of Edinburgh at the age of 18. One of these, On the equilibrium of elastic solids, laid the foundation for an important discovery later in his life, which was the temporary double refraction produced in viscous liquids by shear stress. His other paper was titled Rolling curves, and just as with the paper Oval Curves that he had written at the Edinburgh Academy, Maxwell was again considered too young to stand at the rostrum and present it himself. The paper was delivered to the Royal Society by his tutor Kelland instead.

University of Cambridge, 1850–56

In October 1850, already an accomplished mathematician, Maxwell left Scotland for the University of Cambridge. He initially attended Peterhouse, but before the end of his first term transferred to Trinity College, where he believed it would be easier to obtain a fellowship. At Trinity, he was elected to the elite secret society known as the Cambridge Apostles. In November 1851, Maxwell studied under William Hopkins, whose success in nurturing mathematical genius had earned him the nickname of "senior wrangler-maker". A considerable part of Maxwell's translation of his equations regarding electromagnetism was accomplished during his time at Trinity.

In 1854, Maxwell graduated from Trinity with a degree in mathematics. He scored second highest in the final examination, coming behind Edward Routh, and thereby earning himself the title of Second Wrangler. He was later declared equal with Routh, however, in the more exacting ordeal of the Smith's Prize examination. Immediately after earning his degree, Maxwell read a novel paper to the Cambridge Philosophical Society entitled On the transformation of surfaces

by bending. This is one of the few purely mathematical papers he had written, and it demonstrated Maxwell's growing stature as a mathematician. Maxwell decided to remain at Trinity after graduating and applied for a fellowship, which was a process that he could expect to take a couple of years. Buoyed by his success as a research student, he would be free, aside from some tutoring and examining duties, to pursue scientific interests at his own leisure.

The nature and perception of colour was one such interest, and had begun at Edinburgh University while he was a student of Forbes. Maxwell took the coloured spinning tops invented by Forbes, and was able to demonstrate that white light would result from a mixture of red, green and blue light. His paper, Experiments on colour, laid out the principles of colour combination, and was presented to the Royal Society of Edinburgh in March 1855. Fortunately for Maxwell this time it would be he himself who delivered his lecture.

Maxwell was made a fellow of Trinity on 10 October 1855, sooner than was the norm, and was asked to prepare lectures on hydrostatics and optics, and to set examination papers. However, the following February he was urged by Forbes to apply for the newly vacant Chair of Natural Philosophy at Marischal College, Aberdeen. His father assisted him in the task of preparing the necessary references, but he would die on 2 April, at Glenlair before either knew the result of Maxwell's candidacy. Maxwell nevertheless accepted the professorship at Aberdeen, leaving Cambridge in November 1856.

Aberdeen University, 1856–60

The 25-year-old Maxwell was a decade and a half younger than any other professor at Marischal, but engaged himself with his new responsibilities as head of department, devising the syllabus and preparing lectures. He committed himself to lecturing 15 hours a week, including a weekly pro bono lecture to the local working men's college. He lived in Aberdeen during the six months of the academic year, and spent the summers at Glenlair, which he had inherited from his father.

His mind was focused on a problem that had eluded scientists for two hundred years: the nature of Saturn's rings. It was unknown how they could remain stable without breaking up, drifting away or crashing into Saturn. The problem took on a particular resonance at this time as St John's College, Cambridge had chosen it as the topic for the 1857 Adams Prize. Maxwell devoted two years to studying the problem, proving that a regular solid ring could not be stable, and a fluid ring would be forced by wave action to break up into blobs. Since neither was observed, Maxwell concluded that the rings must comprise numerous small

particles he called "brick-bats", each independently orbiting Saturn. Maxwell was awarded the £130 Adams Prize in 1859 for his essay *On the stability of Saturn's rings*; he was the only entrant to have made enough headway to submit an entry. His work was so detailed and convincing that when George Biddell Airy read it he commented "It is one of the most remarkable applications of mathematics to physics that I have ever seen." It was considered the final word on the issue until direct observations by the Voyager flybys of the 1980s confirmed Maxwell's prediction. Maxwell would also go on to disprove mathematically the nebular hypothesis (which stated that the solar system formed through the progressive condensation of a purely gaseous nebula), forcing the theory to account for additional portions of small solid particles.

In 1857 Maxwell befriended the Reverend Daniel Dewar, who was the Principal of Marischal, and through him met Dewar's daughter, Katherine Mary Dewar. They were engaged in February 1858 and married in Aberdeen on 2 June 1858. On the marriage record, Maxwell is listed as Professor of Natural Philosophy in Marischal College, Aberdeen. Seven years Maxwell's senior, comparatively little is known of Katherine although it is known that she helped in his lab and worked on experiments in viscosity. Maxwell's biographer and friend Campbell adopted an uncharacteristic reticence on the subject of Katherine, though describing their married life as "one of unexampled devotion".

In 1860, Marischal College merged with the neighbouring King's College to form the University of Aberdeen. There was no room for two professors of Natural Philosophy, and Maxwell, despite his scientific reputation, found himself laid off. He was unsuccessful in applying for Forbes' recently vacated chair at Edinburgh, the post instead going to Tait. Maxwell was granted the Chair of Natural Philosophy at King's College London instead. After recovering from a near-fatal bout of smallpox in the summer of 1860, Maxwell headed south to London with his wife Katherine.

King's College London, 1860–65

Maxwell's time at King's was probably the most productive of his career. He was awarded the Royal Society's Rumford Medal in 1860 for his work on colour, and was later elected to the Society in 1861. This period of his life would see him display the world's first light-fast colour photograph, further develop his ideas on the viscosity of gases, and propose a system of defining physical quantities—now known as dimensional analysis. Maxwell would often attend lectures at the Royal Institution, where he came into regular contact with Michael Faraday. The relationship between the two men could not be described as close, as Faraday was 40 years Maxwell's senior and showed signs of senility. They nevertheless

maintained a strong respect for each other's talents.

This time is especially known for the advances Maxwell made in the fields of electricity and magnetism. He had examined the nature of both electric and magnetic fields in his two-part paper *On physical lines of force*, published in 1861, in which he had provided a conceptual model for electromagnetic induction, consisting of tiny spinning cells of magnetic flux. Two more parts later added to the paper were published in early 1862. In the first of these he discussed the nature of electrostatics and displacement current. The final part dealt with the rotation of the plane of polarization of light in a magnetic field, a phenomenon discovered by Faraday and now known as the Faraday effect.

Later years

In 1865, Maxwell resigned the chair at King's College London and returned to Glenlair with Katherine.

He wrote a textbook entitled *Theory of Heat* (1871), and an elementary treatise, *Matter and Motion* (1876). Maxwell was also the first to make explicit use of dimensional analysis, in 1871.

In 1871, he became the first Cavendish Professor of Physics at Cambridge. Maxwell was put in charge of the development of the Cavendish Laboratory. He supervised every step in the progress of the building and of the purchase of the very valuable collection of apparatus paid for by its generous founder, the 7th Duke of Devonshire (chancellor of the university, and one of its most distinguished alumni). One of Maxwell's last great contributions to science was the editing (with copious original notes) of the electrical researches of Henry Cavendish, from which it appeared that Cavendish researched, amongst other things, such questions as the mean density of the earth and the composition of water.

He died in Cambridge of abdominal cancer on 5 November 1879 at the age of 48. His mother had died at the same age of the same type of cancer. Maxwell is buried at Parton Kirk, near Castle Douglas in Galloway, Scotland. The extended biography *The Life of James Clerk Maxwell*, by his former schoolfellow and lifelong friend Professor Lewis Campbell, was published in 1882. His collected works, including the series of articles on the properties of matter, such as "Atom", "Attraction", "Capillary action", "Diffusion", "Ether", etc., were issued in two volumes by the Cambridge University Press in 1890.

Personality

As a great lover of Scottish poetry, Maxwell memorised poems and wrote his own. The best known is *Rigid Body Sings*, closely based on *Comin' Through the Rye* by [Robert Burns](http://www.poemhunter.com/robert-burns/), which he apparently used to sing while accompanying himself on a guitar. It has the opening lines:

Gin a body meet a body
Flyin' through the air.
Gin a body hit a body,
Will it fly? And where?

A collection of his poems was published by his friend Lewis Campbell in 1882. Many appreciations of Maxwell remark upon his remarkable intellectual qualities being matched by social awkwardness.

Ivan Tolstoy, author of one of Maxwell's biographies, has noted the frequency with which scientists writing short biographies of Maxwell omit the subject of his Christianity. He was an evangelical Presbyterian, and in his later years became an Elder of the Church of Scotland. Maxwell's religious beliefs and related activities have been the focus of several peer-reviewed and well-referenced papers. Attending both Church of Scotland (his father's denomination) and Episcopalian (his mother's denomination) services as a child, Maxwell later underwent an evangelical conversion in April 1853, which committed him to an anti-positivist position.

Contributions

Maxwell had studied and commented on the field of electricity and magnetism as early as 1855/6 when "On Faraday's lines of force" was read to the Cambridge Philosophical Society. The paper presented a simplified model of Faraday's work, and how the two phenomena were related. He reduced all of the current knowledge into a linked set of differential equations with 20 equations in 20 variables. This work was later published as "On physical lines of force" in March 1861.

Around 1862, while lecturing at King's College, Maxwell calculated that the speed of propagation of an electromagnetic field is approximately that of the speed of light. He considered this to be more than just a coincidence, and commented "We can scarcely avoid the conclusion that light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena."

Working on the problem further, Maxwell showed that the equations predict the existence of waves of oscillating electric and magnetic fields that travel through empty space at a speed that could be predicted from simple electrical experiments; using the data available at the time, Maxwell obtained a velocity of 310,740,000 m/s. In his 1864 paper "A dynamical theory of the electromagnetic field", Maxwell wrote, "The agreement of the results seems to show that light and magnetism are affections of the same substance, and that light is an electromagnetic disturbance propagated through the field according to electromagnetic laws".

His famous equations, in their modern form of four partial differential equations, first appeared in fully developed form in his textbook *A Treatise on Electricity and Magnetism* in 1873. Most of this work was done by Maxwell at Glenlair during the period between holding his London post and his taking up the Cavendish chair. Maxwell expressed electromagnetism in the algebra of quaternions and made the electromagnetic potential the centerpiece of his theory. In 1881 Oliver Heaviside replaced Maxwell's electromagnetic potential field by 'force fields' as the centerpiece of electromagnetic theory. Heaviside reduced the complexity of Maxwell's theory down to four differential equations, known now collectively as Maxwell's Laws or Maxwell's equations. According to Heaviside, the electromagnetic potential field was arbitrary and needed to be "murdered". However, the use of scalar and vector potentials is now standard in the solution of Maxwell's equations.

A few years later there was a great debate between Heaviside and Peter Guthrie Tait about the relative merits of vector analysis and quaternions. The result was the realization that there was no need for the greater physical insights provided by quaternions if the theory was purely local, and vector analysis became commonplace.

Maxwell was proven correct, and his quantitative connection between light and electromagnetism is considered one of the great accomplishments of 19th century mathematical physics.

Maxwell also introduced the concept of the electromagnetic field in comparison to force lines that Faraday discovered. By understanding the propagation of electromagnetism as a field emitted by active particles, Maxwell could advance his work on light. At that time, Maxwell believed that the propagation of light required a medium for the waves, dubbed the luminiferous aether. Over time, the existence of such a medium, permeating all space and yet apparently undetectable by mechanical means, proved more and more difficult to reconcile with experiments such as the Michelson–Morley experiment. Moreover, it seemed

to require an absolute frame of reference in which the equations were valid, with the distasteful result that the equations changed form for a moving observer. These difficulties inspired Albert Einstein to formulate the theory of special relativity, and in the process Einstein dispensed with the requirement of a luminiferous aether.

Colour Analysis

Maxwell contributed to the field of optics and the study of colour vision, creating the foundation for practical colour photography.

From 1855 to 1872, he published at intervals a series of valuable investigations concerning the perception of colour, colour-blindness and colour theory, for the earlier of which the Royal Society awarded him the Rumford Medal. The instruments which he devised for these investigations were simple and convenient to use. For example, Maxwell's discs were used to compare a variable mixture of three primary colours with a sample colour by observing the spinning "colour top."

In the course of his 1855 paper on the perception of colour, Maxwell proposed that if three black-and-white photographs of a scene were taken through red, green and violet filters, and transparent prints of the images were projected onto a screen using three projectors equipped with similar filters, when superimposed on the screen the result would be perceived by the human eye as a complete reproduction of all the colours in the scene.

During an 1861 Royal Institution lecture on colour theory, Maxwell presented the world's first demonstration of colour photography by this principle of three-colour analysis and synthesis, the basis of nearly all subsequent photochemical and electronic methods of colour photography. Thomas Sutton, inventor of the single-lens reflex camera, did the actual picture-taking. He photographed a tartan ribbon three times, through red, green and blue filters. He also made a fourth exposure through a yellow filter, but according to Maxwell's account this was not used in the demonstration. Because Sutton's photographic plates were in fact insensitive to red and barely sensitive to green, the results of this pioneering experiment were far from perfect. It was remarked in the published account of the lecture that "if the red and green images had been as fully photographed as the blue," it "would have been a truly-coloured image of the riband. By finding photographic materials more sensitive to the less refrangible rays, the representation of the colours of objects might be greatly improved."

Researchers in 1961 concluded that the seemingly impossible partial success of

the red-filtered exposure was due to ultraviolet light. Some red dyes strongly reflect it, the red filter used does not entirely block it, and Sutton's plates were sensitive to it.

The demonstration was not of a print or transparency containing tangible colouring matter, but of colour which was photographically recorded from nature and reproduced by the same additive colour synthesis principle now used by all common types of colour video displays. Maxwell's purpose was not to present a method of colour photography, but to illustrate the basis of human colour perception and to show that the correct additive primaries are not red, yellow and blue, as was then taught, but red, green and blue.

The three photographic plates now reside in a small museum at 14 India Street, Edinburgh, the house where Maxwell was born.

Kinetic theory and thermodynamics

Maxwell also investigated the kinetic theory of gases. Originating with Daniel Bernoulli, this theory was advanced by the successive labours of John Herapath, John James Waterston, James Joule, and particularly Rudolf Clausius, to such an extent as to put its general accuracy beyond a doubt; but it received enormous development from Maxwell, who in this field appeared as an experimenter (on the laws of gaseous friction) as well as a mathematician.

In 1866, he formulated statistically, independently of Ludwig Boltzmann, the Maxwell–Boltzmann kinetic theory of gases. His formula, called the Maxwell distribution, gives the fraction of gas molecules moving at a specified velocity at any given temperature. In the kinetic theory, temperatures and heat involve only molecular movement. This approach generalized the previously established laws of thermodynamics and explained existing observations and experiments in a better way than had been achieved previously. Maxwell's work on thermodynamics led him to devise the Gedankenexperiment (thought experiment) that came to be known as Maxwell's demon.

In 1871, he established Maxwell's thermodynamic relations, which are statements of equality among the second derivatives of the thermodynamic potentials with respect to different thermodynamic variables. In 1874, he constructed a plaster thermodynamic visualisation as a way of exploring phase transitions, based on the American scientist Josiah Willard Gibbs's graphical thermodynamics papers.

Control theory

Maxwell published a famous paper "On governors" in the Proceedings of Royal Society, vol. 16 (1867–1868). This paper is quite frequently considered a classical paper of the early days of control theory. Here governors refer to the governor or the centrifugal governor used in steam engines.

Legacy

Maxwell was ranked 91st on the BBC poll of the 100 Greatest Britons. His name is honoured in a number of ways:

The maxwell (Mx), a compound derived CGS unit measuring magnetic flux.

Maxwell Montes, a mountain range on Venus, one of only three features on the planet that are not given female names.

The Maxwell Gap in the Rings of Saturn.

The James Clerk Maxwell Telescope, the largest submillimetre-wavelength astronomical telescope in the world, with a diameter of 15 metres.

The 1977 James Clerk Maxwell Building of the University of Edinburgh, housing the schools of mathematics, physics and meteorology.

The James Clerk Maxwell building at the Waterloo campus of King's College London, in commemoration of his time as Professor of Natural Philosophy at King's from 1860 to 1865. The university also has a chair in Physics named after him, and a society for undergraduate physicists.

The £4 million James Clerk Maxwell Centre of the Edinburgh Academy was opened in 2006 to mark his 175th anniversary.

James Clerk Maxwell Road in Cambridge, which runs beside the Cavendish Laboratory.

The University of Salford's main building is named after him.

Maxwell bridge, a bridge circuit involving resistors, a capacitor and an inductor

A statue on Edinburgh's George Street

A street in Aberdeen's Kincorth area is named after him

Thomas Pynchon, an American novelist, alludes to and explains Maxwell's demon in *The Crying of Lot 49*.

P J Moore, keyboard player with The Blue Nile is developing a theatre piece based on the life of J.C.M.

A Problem In Dynamics

An inextensible heavy chain
Lies on a smooth horizontal plane,
An impulsive force is applied at A,
Required the initial motion of K.

Let ds be the infinitesimal link,
Of which for the present we've only to think;
Let T be the tension, and $T + dT$
The same for the end that is nearest to B.
Let a be put, by a common convention,
For the angle at M 'twixt OX and the tension;
Let V_t and V_n be ds 's velocities,
Of which V_t along and V_n across it is;
Then V_n/V_t the tangent will equal,
Of the angle of starting worked out in the sequel.

In working the problem the first thing of course is
To equate the impressed and effectual forces.
K is tugged by two tensions, whose difference dT
Must equal the element's mass into V_t .
 V_n must be due to the force perpendicular
To ds 's direction, which shows the particular
Advantage of using da to serve at your
Pleasure to estimate ds 's curvature.
For V_n into mass of a unit of chain
Must equal the curvature into the strain.

Thus managing cause and effect to discriminate,
The student must fruitlessly try to eliminate,
And painfully learn, that in order to do it, he
Must find the Equation of Continuity.
The reason is this, that the tough little element,
Which the force of impulsion to beat to a jelly meant,
Was endowed with a property incomprehensible,
And was "given," in the language of Shop, "inexten-sible."
It therefore with such pertinacity odd defied
The force which the length of the chain should have modified,
That its stubborn example may possibly yet recall
These overgrown rhymes to their prosody metrical.

The condition is got by resolving again,
According to axes assumed in the plane.
If then you reduce to the tangent and normal,
You will find the equation more neat tho' less formal.
The condition thus found after these preparations,
When duly combined with the former equations,
Will give you another, in which differentials
(When the chain forms a circle), become in essentials
No harder than those that we easily solve
In the time a T totum would take to revolve.

Now joyfully leaving ds to itself, a-
Ttend to the values of T and of a.
The chain undergoes a distorting convulsion,
Produced first at A by the force of impulsion.
In magnitude R, in direction tangential,
Equating this R to the form exponential,
Obtained for the tension when a is zero,
It will measure the tug, such a tug as the "hero
Plume-waving" experienced, tied to the chariot.
But when dragged by the heels his grim head could not carry aught,
So give a its due at the end of the chain,
And the tension ought there to be zero again.
From these two conditions we get three equations,
Which serve to determine the proper relations
Between the first impulse and each coefficient
In the form for the tension, and this is sufficient
To work out the problem, and then, if you choose,
You may turn it and twist it the Dons to amuse.

James Clerk Maxwell

A Student's Evening Hymn

I.

Now no more the slanting rays
With the mountain summits dally,
Now no more in crimson blaze
Evening's fleecy cloudless rally,
Soon shall Night front off the valley
Sweep that bright yet earthly haze,
And the stars most musically
Move in endless rounds of praise.

II.

While the world is growing dim,
And the Sun is slow descending
Past the far horizon's rim,
Earth's low sky to heaven extending,
Let my feeble earth-notes, blending
With the songs of cherubim,
Through the same expanse ascending,
Thus renew my evening hymn.

III.

Thou that fill'st our waiting eyes
With the food of contemplation,
Setting in thy darkened skies
Signs of infinite creation,
Grant to nightly meditation
What the toilsome day denies—
Teach me in this earthly station
Heavenly Truth to realise.

IV.

Give me wisdom so to use

These brief hours of thoughtful leisure,
That I may no instant lose
In mere meditative pleasure,
But with strictest justice measure
All the ends my life pursues,
Lies to crush and truths to treasure,
Wrong to shun and Right to choose.

V.

Then, when unexpected Sleep,
O'er my long-closed eyelids stealing,
Opens up that lower deep
Where Existence has no feeling,
May sweet Calm, my languor healing,
Lend me strength at dawn to reap
All that Shadows, world-concealing,
For the bold enquirer keep.

VI.

Through the creatures Thou hast made
Show the brightness of Thy glory,
Be eternal Truth displayed
In their substance transitory,
Till green Earth and Ocean hoary,
Massy rock and tender blade
Tell the same unending story—
"We are Truth in Form arrayed."

VII.

When to study I retire,
And from books of ancient sages
Glean fresh sparks of buried fire
Lurking in their ample pages—
While the task my mind engages
Let old words new truths inspire—
Truths that to all after-ages

Prompt the Thoughts that never tire.

VIII.

Yet if, led by shadows fair
I have uttered words of folly,
Let the kind absorbing air
Stifle every sound unholy.
So when Saints with Angels lowly
Join in heaven's unceasing prayer,
Mine as certainly, though slowly,
May ascend and mingle there.

IX.

Teach me so Thy works to read
That my faith,—new strength accruing,—
May from world to world proceed,
Wisdom's fruitful search pursuing;
Till, thy truth my mind imbuing,
I proclaim the Eternal Creed,
Oft the glorious theme renewing
God our Lord is God indeed.

X.

Give me love aright to trace
Thine to everything created,
Preaching to a ransomed race
By Thy mercy renovated,
Till with all thy fulness sated
I behold thee face to face
And with Ardour unabated
Sing the glories of thy grace.

James Clerk Maxwell

A Vision Of A Wrangler, Of A University, Of Pedantry, And Of Philosophy

Deep St. Mary's bell had sounded,
And the twelve notes gently rounded
Endless chimneys that surrounded
My abode in Trinity.
(Letter G, Old Court, South Attics),
I shut up my mathematics,
That confounded hydrostatics --
Sink it in the deepest sea!

In the grate the flickering embers
Served to show how dull November's
Fogs had stamped my torpid members,
Like a plucked and skinny goose.
And as I prepared for bed, I
Asked myself with voice unsteady,
If of all the stuff I read, I
Ever made the slightest use.

Late to bed and early rising,
Ever luxury despising,
Ever training, never "sizing,"
I have suffered with the rest.
Yellow cheek and forehead ruddy,
Memory confused and muddy,
These are the effects of study
Of a subject so unblest.

Look beyond, and see the wrangler,
Now become a College dangler,
Court some spiritual angler,
Nibbling at his golden bait.
Hear him silence restive Reason,
Her advice is out of season,
While her lord is plotting treason
Gainst himself, and Church or State.

See him next with place and pension,

And the very best intention
Of upholding that Convention
Under which his fortunes rose.
Every scruple is rejected,
With his cherished schemes connected,
"Higher Powers may be neglected --
His result no further goes."

Much he lauds the education
Which has raised to lofty station,
Men, whose powers of calculation
Calculation's self defied.
How the learned fool would wonder
Were he now to see his blunder,
When he put his reason under
The control of worldly Pride.

Thus I muttered, very seedy,
Husky was my throat, and reedy;
And no wonder, for indeed I
Now had caught a dreadful cold.
Thickest fog had settled slowly
Round the candle, burning lowly,
Round the fire, where melancholy
Traced retreating hills of gold.

Still those papers lay before me --
Problems made express to bore me,
When a silent change came o'er me,
In my hard uneasy chair.
Fire and fog, and candle faded,
Spectral forms the room invaded,
Little creatures, that paraded
On the problems lying there.

Fathers there, of every college,
Led the glorious ranks of knowledge,
Men, whose virtues all acknowledge
Levied the proctorial fines;
There the modest Moderators,
Set apart as arbitrators
'Twixt contending calculators,

Scrutinised the trembling lines.

All the costly apparatus,
That is meant to elevate us
To the intellectual status
Necessary for degrees --
College tutors -- private coaches --
Line the Senate-house approaches.
If our Alma Mater dote, she's
Taken care of well by these.

Much I doubted if the vision
Were the simple repetition
Of the statements of Commission,
Strangely jumbled, oddly placed.
When an awful form ascended,
And with cruel words defended
Those abuses that offended
My unsanctioned private taste.

Angular in form and feature,
Unlike any earthly creature,
She had properties to meet your
Eye whatever you might view.
Hair of pens and skin of paper;
Breath, not breath but chemic vapour;
Dress, -- such dress as College Draper
Fashions with precision due.

Eyes of glass, with optic axes
Twisting rays of light as flax is
Twisted, while the Parallax is
Made to show the real size.
Primary and secondary
Focal lines in planes contrary,
Sum up all that's known to vary
In those dull, unmeaning eyes.

Such the eyes, through which all Nature
Seems reduced to meaner stature.
If you had them you would hate your
Symbolising sense of sight.

Seeing planets in their courses
Thick beset with arrowy "forces,"
While the common eye no more sees
Than their mild and quiet light.

"Son," she said (what could be queerer
Than thus tête-à-tête to hear her
Talk, in tones approaching nearer
To a saw's than aught beside?
For the voice the spectre spoke in
Might be known by many a token
To proceed from metal, broken
When acoustic tricks were tried.

Little pleased to hear the Siren
"Own" me thus with voice of iron,
I had thoughts of just retiring
From a mother such a fright).
"No," she said, "the time is pressing,
So before I give my blessing,
I'll excuse you from confessing
What you thought of me to-night.

"Powers!" she cried, with hoarse devotion,
"Give my son the clearest notion
How to compass sure promotion,
And take care of Number One.
Let his college course be pleasant,
Let him ever, as at present,
Seem to have read what he hasn't,
And to do what can't be done.

Of the Philosophic Spirit
Richly may my son inherit;
As for Poetry, inter it
With the myths of other days.
Cut the thing entirely, lest yon
College Don should put the question,
Why not stick to what you're best on?
Mathematics always pays."

As the Hag was thus proceeding

To prescribe my course of reading,
And as I was faintly pleading,
Hardly knowing what to say,
Suddenly, my head inclining
I beheld a light form shining;
And the withered beldam, whining,
Saw the same and slunk away.

Then the vision, growing brighter,
Seemed to make my garret lighter;
As when noisome fogs of night are
Scattered by the rising sun.
Nearer still it grew and nearer,
Till my straining eyes caught clearer
Glimpses of a being dearer,
Dearer still than Number One.

In that well-remembered Vision
I was led to the decision
Still to hold in calm derision
Pedantry, however draped;
Since that artificial spectre
Proved a paltry sub-collector,
And had nothing to connect her
With the being whom she aped.

I could never finish telling
You of her that has her dwelling
Where those springs of truth are welling,
Whence all streams of beauty run.
She has taught me that creation
Bears the test of calculation,
But that Man forgets his station
If he stops when that is done.

Is our algebra the measure
Of that unexhausted treasure
That affords the purest pleasure,
Ever found when it is sought?
Let us rather, realising
The conclusions thence arising
Nature more than symbols prizing,

Learn to worship as we ought.

Worship? Yes, what worship better
Than when free'd from every fetter
That the uninforming letter
Rivets on the tortured mind,
Man, with silent admiration
Sees the glories of Creation,
And, in holy contemplation,
Leaves the learned crowd behind!

James Clerk Maxwell

An Onset

Hallo ye, my fellows! arise and advance,
See the white-crested waves how they stamp and they dance!
High over the reef there in anger and might,
So wildly we dance to the bloody red fight.
Than gather, now gather, come gather ye all,
Each thing that hath legs and arms, come to our call;
Like reeds on the moor when the whirlwinds vie
Our lances and war-axes darken the sky;
Sharp, sharp, as the tooth of the sea-hound and shark,
They'll tear ye, they'll split ye, fly lance to the mark,
Home, home to the heart, and thou battle-axe grim,
Split, splintring and shivering through brain-pan and limb;
To-day we ask vengeance, to-day we ask blood,
We ask it; we're coming to make our words good;
The storm flinches not tho' the woods choke its path,
We ask it; we're coming, beware of our wrath.
At home wives and children a hearth for us lay,
A savoury flesh-feast awaits us to-day;
Behind yonder mountains e'en now the smoke streams,
And the blaze of the bush fire crackles and gleams.
Long, long have we hungered and thirsted for you,
At home the dogs bark round the clean table too,
Loud shouting we'll eat you to-night every one,
Devour you clean to the white sinewy bone.
Rush, rush ye my fellows, rush on them like hail,
Soon, soon shall their roasting your nostrils regale,
The fire is flaring, the oven's a glow,
Heave to now hew thro' now, Holloa, Hollo.

James Clerk Maxwell

Answer To Tait

The mounted disk of ebonite
Has whirled before, nor whirled in vain;
Rowland of Troy, that doughty knight,
Convection currents did obtain
In such a disk, of power to wheedle,
From its loved North the subtle needle.

'Twas when Sir Rowland, as a stage
From Troy to Baltimore, took rest
In Berlin, there old Archimage,
Armed him to follow up this quest;
Right glad to find himself possessor
Of the irrepressible Professor.

But wouldst thou twirl that disk once more,
Then follow in Childe Rowland's train,
To where in busy Baltimore
He brews the bantlings of his brain;
As he may do who still prefers
One Rowland to two Olivers.

But Rowland,—no, nor Oliver,—
Could get electromotive force,
Which fact and reason both aver,
Has change of some kind as its source,
Out of a disk in swift rotation
Without the least acceleration.

But with your splendid roundabout
Of mighty power, new-hung and greasy,
With galvanometer so stout,
A new research would be as easy;
A test which might perchance disclose,
Which way the electric current flows.

Take then a coil of copper pure,
And fix it on your whirling table;
Place the electrodes firm and sure
As near the axis as you're able,

And soon you'll learn the way to work it,
With galvanometer in circuit.

Not while the coil in spinning sleeps,
On her smooth axle swift and steady;
But when against the stops she sweeps,
To watch the light-spot then be ready,
That you may learn from its deflexion
The electric current's true direction.

It may be that it does not move,
Or moves but for some other reason;
Then let it be your boast to prove
(Though some may think it out of season,
And worthy of a fossil Druid),
That there is no Electric Fluid.

James Clerk Maxwell

British Association, Notes Of The President's Address

In the very beginnings of science, the parsons, who managed things then,
Being handy with hammer and chisel, made gods in the likeness of men;
Till Commerce arose, and at length some men of exceptional power
Supplanted both demons and gods by the atoms, which last to this hour.
Yet they did not abolish the gods, but they sent them well out of the way,
With the rarest of nectar to drink, and blue fields of nothing to sway.
From nothing comes nothing, they told us, nought happens by chance, but by
fate;

There is nothing but atoms and void, all else is mere whims out of date!
Then why should a man curry favour with beings who can-not exist,
To compass some petty promotion in nebulous kingdoms of mist?
But not by the rays of the sun, nor the glittering shafts of the day,
Must the fear of the gods be dispelled, but by words, and their wonderful play.
So treading a path all untrod, the poet-philosopher sings
Of the seeds of the mighty world—the first-beginnings of things;
How freely he scatters his atoms before the beginning of years;
How he clothes them with force as a garment, those small incompressible
spheres!

Nor yet does he leave them hard-hearted—he dowers them with love and with
hate,

Like spherical small British Asses in infinitesimal state;
Till just as that living Plato, whom foreigners nickname Plateau,
Drops oil in his whisky-and-water (for foreigners sweeten it so),
Each drop keeps apart from the other, enclosed in a flexible skin,
Till touched by the gentle emotion evolved by the prick of a pin:
Thus in atoms a simple collision excites a sensational thrill,
Evolved through all sorts of emotion, as sense, understanding, and will;
(For by laying their heads all together, the atoms, as coun-cillors do,
May combine to express an opinion to every one of them new).
There is nobody here, I should say, has felt true indignation at all,
Till an indignation meeting is held in the Ulster Hall;
Then gathers the wave of emotion, then noble feelings arise,
Till you all pass a resolution which takes every man by surprise.
Thus the pure elementary atom, the unit of mass and of thought,
By force of mere juxtaposition to life and sensation is brought;
So, down through untold generations, transmission of struc-tureless germs
Enables our race to inherit the thoughts of beasts, fishes, and worms.
We honour our fathers and mothers, grandfathers and grand-mothers too;
But how shall we honour the vista of ancestors now in our view?

First, then, let us honour the atom, so lively, so wise, and so small;
The atomists next let us praise, Epicurus, Lucretius, and all;
Let us damn with faint praise Bishop Butler, in whom many atoms combined
To form that remarkable structure, it pleased him to call—his mind.
Last, praise we the noble body to which, for the time, we belong,
Ere yet the swift whirl of the atoms has hurried us, ruth-less, along,
The British Association—like Leviathan worshipped by Hobbes,
The incarnation of wisdom, built up of our witless nobs,
Which will carry on endless discussions, when I, and prob-ably you,
Have melted in infinite azure—in English, till all is blue.

James Clerk Maxwell

Cats Cradle Song, By A Babe In Knots

Peter the Repeater,
Platted round a platter
Slips of slivered paper,
Basting them with batter.

Flype 'em, slit 'em, twist 'em,
Lop-looped laps of paper;
Setting out the system
By the bones of Neper.

Clear your coil of kinkings
Into perfect plaiting,
Locking loops and linkings
Interpenetrating.

Why should a man benighted,
Beduped, befooled, besotted,
Call knotful knittings plighted,
Not knotty but beknotted?

It's monstrous, horrid, shocking,
Beyond the power of thinking,
Not to know, interlocking
Is no mere form of linking.

But little Jacky Horner
Will teach you what is proper,
So pitch him, in his corner,
Your silver and your copper.

James Clerk Maxwell

Horace, Seventh Epode

Whither, whither, reckless Romans,
Are you rushing, sword in hand?
Has not yet the blood of brothers,
Fully stained the sea and land?

Not that raging conflagration
Should o'er fallen Carthage play;
Not that the unconquered Briton
Should descend the sacred way.

"Rome," exclaims the joyful Parthian,
"Ruin for herself prepares;
Wolves with wolves are never savage,
Lion lion never tears."

Is this fury? is it madness?
Speedy answer I demand;
Foolish, blinded, guilty Romans,
Silent, stupefied you stand. [590]

Thus 'tis fated, blood of brothers
Must atone for brothers' guilt,
Since the blood of injured Remus
Romulus in anger spilt.

James Clerk Maxwell

In Memory Of Edward Wilson, Who Repented Of What Was In His Mind To Write After Section

Rigid Body (sings).

Gin a body meet a body
Flyin' through the air,
Gin a body hit a body,
Will it fly? and where?
Ilka impact has its measure,
Ne'er a ane hae I,
Yet a' the lads they measure me,
Or, at least, they try.

Gin a body meet a body
Altogether free,
How they travel afterwards
We do not always see.
Ilka problem has its method
By analytics high;
For me, I ken na ane o' them,
But what the waur am I?

James Clerk Maxwell

I've Heard The Rushing

I've heard the rushing of mountain torrents, gushing
Down through the rocks, in a cataract of spray,
Onward to the ocean;
Swift seemed their motion,
Till, lost in the desert, they dwindled away.

I've learnt the story of all human glory,
I've felt high resolves growing weaker every day,
Till cares, springing round me,
With creeping tendrils bound me,
And all I once hoped for was wearing fast away.

I've seen the river rolling on for ever,
Silent and strong, without tumult or display.
In the desert arid,
Its waters never tarried,
Till far out at sea we still found them on their way.

Now no more weary we faint in deserts dreary,
Toiling alone till the closing of the day;
All now is righted,
Our souls flow on united,
Till the years and their sorrows have all died away.

James Clerk Maxwell

Lectures To Women On Physical Science

I.

PLACE. -- A small alcove with dark curtains.

The class consists of one member.

SUBJECT. -- Thomson's Mirror Galvanometer.

The lamp-light falls on blackened walls,
And streams through narrow perforations,
The long beam trails o'er pasteboard scales,
With slow-decaying oscillations.
Flow, current, flow, set the quick light-spot flying,
Flow current, answer light-spot, flashing, quivering, dying,

O look! how queer! how thin and clear,
And thinner, clearer, sharper growing
The gliding fire! with central wire,
The fine degrees distinctly showing.
Swing, magnet, swing, advancing and receding,
Swing magnet! Answer dearest, What's your final reading?

O love! you fail to read the scale
Correct to tenths of a division.
To mirror heaven those eyes were given,
And not for methods of precision.
Break contact, break, set the free light-spot flying;
Break contact, rest thee, magnet, swinging, creeping, dying.

II.

*Professor Chrschtschonovitsch, Ph.D., "On the C. G. S. system of Units."
Remarks submitted to the Lecturer by a student.*

Prim Doctor of Philosophy
Front academic Heidelberg!
Your sum of vital energy
Is not the millionth of an erg.

Your liveliest motion might be reckoned
At one-tenth metre in a second.
"The air," you said, in language fine,
Which scientific thought expresses,
"The air -- which with a megadyne,
On each square centimetre presses --
The air, and I may add the ocean,
Are nought but molecules in motion."

Atoms, you told me, were discrete,
Than you they could not be discreter,
Who know how many Millions meet
Within a cubic millimetre.
They clash together as they fly,
But you! -- you cannot tell me why.

And when in tuning my guitar
The interval would not come right,
"This string," you said, "is strained too far,
'Tis forty dynes, at least too tight!"
And then you told me, as I sang,
What overtones were in my clang.

You gabbled on, but every phrase
Was stiff with scientific shoddy,
The only song you deigned to praise
Was "Gin a body meet a body,"
"And even there," you said, "collision
Was not described with due precision."

"In the invariable plane,"
You told me, "lay the impulsive couple."
You seized my hand -- you gave me pain,
By torsion of a wrist so supple;
You told me what that wrench would do, --
"T'would set me twisting round a screw."

Were every hair of every tress
(Which you, no doubt, imagine mine),
Drawn towards you with its breaking stress --
A stress, say, of a megadyne,
That tension I would sooner suffer

Than meet again with such a duffer!

James Clerk Maxwell

Lines Written Under The Conviction That It Is Not Wise To Read Mathematics In November After One's Fire Is Out

In the sad November time,
When the leaf has left the lime,
And the Cam, with sludge and slime,
Plasters his ugly channel,
While, with sober step and slow,
Round about the marshes low,
Stiffening students stumping go
Shivering through their flannel.

Then to me in doleful mood
Rises up a question rude,
Asking what sufficient good
Comes of this mode of living?
Moping on from day to day,
Grinding up what will not "pay,"
Till the jaded brain gives way
Under its own misgiving.

Why should wretched Man employ
Years which Nature meant for joy,
Striving vainly to destroy
Freedom of thought and feeling?
Still the injured powers remain
Endless stores of hopeless pain,
When at last the vanquished brain
Languishes past all healing.

Where is then his wealth of mind --
All the schemes that Hope designed?
Gone, like spring, to leave behind
Indolent melancholy.
Thus he ends his helpless days,
Vex't with thoughts of former praise --
Tell me, how are Wisdom's ways
Better than senseless Folly?

Happier those whom trifles please,
Dreaming out a life of ease,
Sinking by unfelt degrees
Into annihilation.
Or the slave, to labour born,
Heedless of the freeman's scorn,
Destined to be slowly worn
Down to the brute creation.

Thus a tempting spirit spoke,
As from troubled sleep I woke
To a morning thick with smoke,
Sunless and damp and chilly.
Then to sleep I turned once more,
Eyes inflamed and windpipe sore,
Dreaming dreams I dreamt before,
Only not quite so silly.

In my dream methought I strayed
Where a learned-looking maid
Stores of flimsy goods displayed,
Articles not worth wearing.
"These," she said, with solemn air,
"Are the robes that sages wear,
Warranted, when kept with care,
Never to need repairing."

Then unnumbered witlings, caught
By her wiles, the trappings bought,
And by labour, not by thought,
Honour and fame were earning.
While the men of wiser mind
Passed for blind among the blind;
Pedants left them far behind
In the career of learning.

"Those that fix their eager eyes
Ever on the nearest prize
Well may venture to despise
Loftier aspirations.
Pedantry is in demand!
Buy it up at second-hand,

Seek no more to understand
Profitless speculations."

Thus the gaudy gowns were sold,
Cast off sloughs of pedants old;
Proudly marched the students bold
Through the domain of error,
Till their trappings, false though fair,
Mouldered off and left them bare,
Clustering close in blank despair,
Nakedness, cold, and terror.

Then, I said, "These haughty Schools
Boast that by their formal rules
They produce more learned fools
Than could be well expected.
Learned fools they are indeed,
Learned in the books they read;
Fools whene'er they come to need
Wisdom, too long neglected.

"Oh! that men indeed were wise,
And would raise their purblind eyes
To the opening mysteries
Scattered around them ever.
Truth should spring from sterile ground,
Beauty beam from all around,
Right should then at last be found
Joining what none may sever."

James Clerk Maxwell

Molecular Evolution

At quite uncertain times and places,
The atoms left their heavenly path,
And by fortuitous embraces,
Engendered all that being hath.
And though they seem to cling together,
And form "associations" here,
Yet, soon or late, they burst their tether,
And through the depths of space career.

So we who sat, oppressed with science,
As British asses, wise and grave,
Are now transformed to wild Red Lions,
As round our prey we ramp and rave.
Thus, by a swift metamorphosis,
Wisdom turns wit, and science joke,
Nonsense is incense to our noses,
For when Red Lions speak, they smoke.

Hail, Nonsense! dry nurse of Red Lions,
From thee the wise their wisdom learn,
From thee they cull those truths of science,
Which into thee again they turn.
What combinations of ideas,
Nonsense alone can wisely form!
What sage has half the power that she has,
To take the towers of Truth by storm?

Yield, then, ye rules of rigid reason!
Dissolve, thou too, too solid sense!
Melt into nonsense for a season,
Then in some nobler form condense.
Soon, all too soon, the chilly morning,
This flow of soul will crystallize,
Then those who Nonsense now are scorning,
May learn, too late, where wisdom lies.

James Clerk Maxwell

Nathalocus

I.

Bleak was the pathway and barren the mountain,
As the traveller passed on his wearisome way,
Sealed by the frost was each murmuring fountain,
And the sun shone through mist with a blood-coloured ray.
But neither the road nor the danger together,
Could alter his purpose, nor yet the rough weather;
So on went the wayfarer through the thick heather,
Till he came to the cave where the dread witches stay.

II.

Hewn from the rock was that cavern so dreary,
And the entrance by bushes was hid from the sight,
But he found his way in, and with travelling weary,
With joy he beheld in the darkness a light.
And in a recess of that wonderful dwelling,
He heard the strange song of the witch wildly swelling,
In magical numbers unceasingly telling
The fortunes of kingdoms, the issue of fight.

III.

Up rose the witch as the traveller entered,
"Welcome," she said, "and what news from the king;
And why to inquire of me thus has he ventured,
When he knows that the answer destruction will bring?
Sit here and attend." Then her pale visage turning
To where the dim lamp in the darkness was burning,
She took up a book of her magical learning,
And prepared in prophetic numbers to sing.

IV.

Now she is seated, the curtain is o'er her,

The god is upon her; attend then and hear!
The vapour is rising in volumes before her,
And forms of the future in darkness appear.
Hark, now the god inspiration is bringing,
'Tis not her voice through the cavern is ringing;
No, for the song her familiar is singing,
And these were the words of the maddening seer.

V.

"Slave of the monarch, return to thy master,
Whisper these words in Nathalocus' ear;
Tell him, from me, that Old Time can fly faster
Than he is aware, for his death hour is near;
Tell him his fate with the mystery due it,
But let him not know of the hand that shall do it;"
"Tell me, vile witch, or I swear thou shalt rue it!"
"Thou art the murderer," answered the seer.

VI.

"Am I a dog that I'd do such an action!"
Answered the chief as in anger he rose,
"Would I, ungrateful, be head of a faction,
And call myself one of Nathalocus' foes?"
"No more," said the witch, "the enchantment is ended,
I brave not the wrath of the demon offended,
Whatever thy fate, 'tis not now to be mended."
So the stranger returned through the thick-driving snows.

VII.

High from his eyrie the eagle was screaming,
Pale sheeted spectres stalked over the heath;
Bright in his mind's eye a dagger was gleaming,
Waiting the moment to spring from its sheath.
Hoarse croaked the raven that eastward was flying;
Well did he know of the king that was dying;
Down in the river the Kelpie was sighing,

Mourning the king in the water beneath.

VIII.

His mind was confused with this terrible warning,
Horrible spectres were with him by night;
Still in his sorrow he wished for the morning,
Cursing the day when he first saw the light.
He said in his raving, "The day that she bore me,
Would that my mother in pieces had tore me;
See there is Nathalocus' body before me;
Hence, ye vain shadows, depart from my sight!"

IX.

And when from the palace the king sent to meet him,
To ask what response from the witch he might bear;
When the messenger thought that the stranger would greet him,
He answered by nought but a meaningless stare.
On his face was a smile, but it was not of gladness,
For all was within inconsolable sadness.
And aye in his eye was the fixt glare of madness,—
"In the king's private chamber, I'll answer him there."

X.

"Tell me, my sovereign, have I been unruly;
Have I been ever found out of my place;
Have not I followed thee faithfully, truly,
Though danger and death stared me full in the face?
Have I been seen from the enemy flying,
Have I been wanting in danger most trying?
Oh, if I have, judge me worthy of dying,
Let me be covered with shame and disgrace!

XI.

"Couldst thou imagine that I should betray thee,

I whom thy bounty with friendship has blessed?
But the witch gave for answer that my hand should slay thee,
'Tis this that for long has deprived me of rest,
Ever since then have my slumbers been broken,
But true are the words that the prophet has spoken,
Nathalocus, now receive this as a token,"
So saying the dagger he plunged in his breast.

James Clerk Maxwell

Ninth Ode Of The Third Book Of Horace

Horace.

While I was your beloved one,
And while no other youth threw his fond arms around
Your white neck so easily,
Than the King of the world I was far happier.

Lydia..

While you loved not another one,
While you did not prefer Chloë to Lydia,
I then thought myself happier
Than the mother of Rome, great Rhea Silvia.

Horace..

Thracian Chloë now governs me,
She can merrily sing, playing the cithara;
I'd not scruple to die for her,
If the Implacable spared Chloë, the auburn haired.

Lydia.

I now love and am loved again,
By my Calais, son of the old Ornytus;
Twice I'd die for him willingly,
If the terrible fates spared but my Calais.

Horace.

What if love should return again,
And unite us by ties more indissoluble?
What if Chloë were cast away,
And the long-closed door open to Lydia?

Lydia.

My love's brighter than any star;
You, too, lighter than cork, tossed on the waves of the Hadriatic so terrible;
Still I'd live but with thee, and I could die with thee.

James Clerk Maxwell

Numa Pompilius

O well is thee! King Numa,
Within thy secret cave,
Where thy bones are ever moistened
By sad Egeria's wave;
None now have power to pilfer
The treasure of thy tomb,
And reveal the institutions
And secret Rites of Rome.
O blessed be the Senate
That stowed those books away,
Curst be the attempt of Niebuhr
To drag them into day;
Light be the pressure, Numa,
Around thy watery bed,
May no perplexing problems
Infest thy kingly head!
As thus I blessed King Numa
And struggled hard with sleep,
I felt unwonted chillness
O'er all my members creep;
Before mine eyes in fragments
The fireplace seemed to roll,
The chillness left my body
And slid into my soul.
Deep in Egeria's grotto
I saw the darksome well;
I slowly sunk to Numa,
But why I cannot tell.

"What! Livest thou still, old Sabine,
With thy mysterious wife?"
"Yes, here beneath the surface,
We lead a torpid life.
But little think the Critics
Who nullify old Rome,
That in these benumbing waters
I always lived at home.
Never was I a Sabine,
Or lived like men above;

No mortal wight was Numa,
Who quelled the fear of Jove.
Before my day the Romans
Served gods of wood and stone,
But what each man had fashioned
That worshipped he alone;
With care he saved the silver,
With pains the mould designed,
He loved and feared the offspring
Of his pocket and his mind.
To him he went for counsel
And then to Common Sense;
When both of these had failed him
He took to tossing pence;
But I forbade all tossing,
Made men enquire of beasts,
Pulled down all private idols
And set up public priests.
Birds, too,' said I, 'are holy,
They show us things to come,
They have more subtle spirits
Than wooden idols dumb.
No longer burn your incense
Before your private shrine,
My Vestals are most careful
To feed the flame divine;
Dismiss all fear of idols,
Of demons, and of gods,
My Augurs will protect you
With their long crooked rods.
(With such the careful shepherd
Drags lambs from ditches deep;
With such he points to heaven
When they are fast asleep.)
O, trust me, those same Augurs
Know more about the stars
Than you whose only business
Is everlasting wars.
How can you be religious,
How can they work for bread?
You sinners must be shriven,
My Augurs must be fed.

You know dividing labour
To nations riches brings,
So let my Augurs shrive you
While you mind earthly things.
Your case I've set before you,
You see the thing to do,
If you fork out the needful,
They do your job for you.'
With this and other speeches
I brought the people round,
Till not a single Roman
In Jove's house can be found.
For well he knows each evening
When bells in steeples toll,
'Tis a sign that well-paid Augurs
Are helping on his soul.
'Twas this that kept 'em quiet
Through all my fabled reign,
Till quarrelsome young Tullus
Brought battles back again.
Thus my cold-blooded doctrines
The fear of Jove could quell,
Wonder not then to find me
Alive here in a well."

James Clerk Maxwell

On St. David's Day

<i>To Mrs. E.C. Morrieson</i>

'Twas not chance but deep design,
Tho' of whom I can't divine
Made the courtly Valentine
(Corpulent saint and bishop)
Such a time with Bob to stay:--
Let me now in bardish way
On your own St. David's day
Toss you a simple dish up.

'Tis a tale we learnt at school,—
Oft we broke domestic rule,
Standing till our brows were cool
In the forbidden lobby.
There we talked and there we laughed,
Till the townsfolk thought us daft,
What of that? a thorough draft
Was and is still my hobby.

To my tale: In ancient days,
Ere men left the good old ways,
Lived a lady whose just praise
Passes all fancied glory.
Rich was she in field and store,
Richer in the sons she bore,
How could she be honoured more?
Listen and hear the story.

On a high and festive day
When the chariots bright and gay
To the temple far away
Passed in majestic order,—
When the hour was nigh at hand,
She who should have led the band
Found no oxen at command,
Searching through all her border

Then her two sons brave and strong
Gut their limbs with band and thong,
And before the wondering throng
Drew their exulting mother.
Swift and steady, on they came;
At the temple loud acclaim
Greeted that illustrious dame,
Blest above every other.

Then, while triumph filled her breast,
Loud she prayed above the rest,
Give my sons whatever best
Man may receive from heavens.
To the shrine the brothers stept,
Low they bowed, they sunk, they slept,
Stillness o'er their brave limbs crept:—
Rest was the guerdon given.

Such the simple story told,
By a sage renowned of old,
To a king whose fabled gold
Could not procure him learning.
Heathen was the sage indeed,
Yet his tale we gladly read,
Thro' his dark and doubtful creed
Glimpses of Truth discerning.

Now no more the altar's blaze
Glares athwart our worldly haze,
Warning men how evil ways
Lead to just tribulation.
Now no more the temple stands,
Pointing out to godless lands
That which is not made with hands,
Even the whole Creation.

Ask no more, then, "what is best,
How shall those you love be blest,"
Ask at once, eternal Rest,
Peace and assurance giving.
Rest of Life and not of death,
Rest in Love and Hope and Faith,

Till the God who gives their breath
Calls them to rest from living.

James Clerk Maxwell

Professor Tait, Loquitur

Will mounted ebonite disk
On smooth unyielding bearing,,
When turned about with notion brisk
(Nor excitation sparing),
Affect the primitive repose,
Of + and — in a wire,
So that while either downward flows,
The other upwards shall aspire?
Describe the form and size of coil,
And other things that we may need,
Think not about increase of toil
Involved in work at double speed.
I can no more, my pen is bad,
It catches in the roughened page—
But answer us and make us glad,
THOU ANTI-DISTANCE-ACTION SAGE!
Yet have I still a thousand things to say
But work of other kinds is pressing—
So your petitioner will ever pray
That your defence be triple messing.

James Clerk Maxwell

Recollections Of A Dreamland

Rouse ye! torpid daylight-dreamers, cast your carking cares away!
As calm air to troubled water, so my night is to your day;
All the dreary day you labour, groping after common sense,
And your eyes ye will not open on the night's magnificence.
Ye would scow were I to tell you how a guiding radiance gleams
On the outer world of action from my inner world of dreams.

When, with mind released from study, late I lay note down to sleep,
From the midst of facts and figures, into boundless space I leap;
For the inner world grows wider as the outer disappears,
And the soul, retiring inward, finds itself beyond the spheres.
Then, to this unbroken sameness, some fantastic dream succeeds,
Vague emotions rise and ripen into thoughts and words and deeds.
Old impressions, long forgotten, range themselves in Time and Space,
Till I recollect the features of some once familiar place.
Then from valley into valley in my dreaming course I roam,
Till the wanderings of my fancy end, where they began, at home.
Calm it lies in morning twilight, while each streamlet far and wide
Still retains its hazy mantle, borrowed from the mountain's side;
Every knoll is now an island every wooded bank a shore,
To the lake of quiet vapour that has spread the valley o'er.
Sheep are couched on every hillock, waiting till the morning dawns,
Hares are on their early rambles, limping o'er the dewy lawns.
All within the house is silent, darkened all the chambers seem,
As with noiseless step I enter, gliding onwards in my dream.

What! has Time run out his cycle, do the years return again?
Are there treasure-caves in Dreamland where departed days remain?
I have leapt the bars of distance—left the life that late I led—
I remember years and labours as a tale that I have read;
Yet my heart is hot within me, for I feel the gentle power
Of the spirits that still love me, waiting for this sacred hour.
Yes,—I know the forms that meet me are but phantoms of the brain,
For they walk in mortal bodies, and they have not ceased from pain.
Oh! those signs of human weakness, left behind for ever now,
Dearer far to me than glories round a fancied seraph's brow.
Oh! the old familiar voices ! Oh! the patient waiting eyes!
Let me live with them in dreamland, while the world in slumber lies!
For by bonds of sacred honour will they guard my soul in sleep

From the spells of aimless fancies, that around my senses creep.
They will link the past and present into one continuous life,
While I feel their hope, their patience, nerve me for the daily strife.
For it is not all a fancy that our lives and theirs are one,
And we know that all we see is but an endless work begun.
Part is left in Nature's keeping, part is entered into rest,
Part remains to grow and ripen, hidden in some living breast.
What is ours we know not, either when we wake or when we sleep,
But we know that Love and Honour, day and night, are ours to keep.
What though Dreams be wandering fancies, by some lawless force entwined,
Empty bubbles, floating upwards through the current of the mind?
There are powers and thoughts within us, that we know not, till they rise
Through the stream of conscious action from where Self in secret lies.
But when Will and Sense are silent, by the thoughts that come and go,
We may trace the rocks and eddies in the hidden depths below.

Let me dream my dream till morning; let my mind run slow and clear,
Free from all the world's distraction, feeling that the Dead are near,
Let me wake, and see my duty lie before me straight and plain.
Let me rise refreshed, and ready to begin my work again.

James Clerk Maxwell

Reflex Musings: Reflections From Various Surfaces

In the dense entangled street,
Where the web of Trade is weaving,
Forms unknown in crowds I meet
Much of each and all believing;
Each his small designs achieving
Hurries on with restless feet,
While, through Fancy's power deceiving,
Self in every form I greet.

Oft in yonder rocky dell
Neath the birches' shadow seated,
I have watched the darksome well,
Where my stooping form, repeated,
Now advanced and now retreated
With the spring's alternate swell,
Till destroyed before completed
As the big drops grew and fell.

By the hollow mountain-side
Questions strange I shout for ever,
While the echoes far and wide
Seem to mock my vain endeavour;
Still I shout, for though they never
Cast my borrowed voice aside,
Words from empty words they sever—
Words of Truth from words of Pride.

Yes, the faces in the crowd,
And the wakened echoes, glancing
From the mountain, rocky browed,
And the lights in water dancing—
Each my wandering sense entrancing,
Tells me back my thoughts aloud,
All the joys of Truth enhancing
Crushing all that makes me proud.

James Clerk Maxwell

Reply To The Above, By F.W.F.

"Te quoque vatem dicunt pastores."—VIRGIL.

O Maxwell, if by reason's strength
And studying of Babbage,
You have transformed yourself at length
Into a mental cabbage;
And if I've proved myself a lark
At morn and blushing even,
By soaring like a music-spark
Thro' sapphire fields of Heaven,

Our diverse fates are now reversed
By strange metempsychosis,
Into a cabbage I have burst
And scorn poetic posies;
But you a lark with twinkling wings
O'er violet-banks are soaring;
Your voice the dewy rose-cloud rings
While Statics me are boring.

Yet cabbage as I will—on earth
My roots I cannot anchor,
For at my mathematic birth
Was also born a canker!
It soon will gnaw my roots away—
But when I weigh a chœnix
I'll freely soar to realms of day
An emerald cabbage-Phoenix.

Then talk not of the Poll to me,
I hate, detest, and scorn it;
I am as earnest as a bee,
But savage as a hornet.
And if they pluck me I will drown
Each pedant in a sonnet,
And of their pluckings make a crown
With golden plumes upon it.

So if my cabbage growth be slow
I'll try to be a carrot,
Or still remain a lark—but know
I'll not be Poll, or Parrot.
Then if I fall beneath the mark,
I'll shout with accent savage,
"It is a lark to be a lark,
'Tis green to be a cabbage"

James Clerk Maxwell

Report On Tait's Lecture On Force

Ye British Asses, who expect to hear
Ever some new thing,
I've nothing new to tell, but what, I fear,
May be a true thing.
For Taft comes with his plummet and his line,
Quick to detect your
Old bosh new dressed in what you call a fine
Popular lecture.

Whence comes that most peculiar smattering,
Heard in our section?
Pure nonsense, to a scientific swing
Drilled to perfection?
That small word "Force," they make a barber's block,
Ready to put on
Meanings most strange and various, fit to shock
Pupils of Newton.

Ancient and foreign ignoranee they throw
Into the bargain;
The shade of Leitnitz mutters from below
Horrible jargon.
The phrases of last century in this
Linger to play tricks—
Vis Viva and Vis Mortua and Vis
Acceleratrix:—

Those long-nabbed words that to our text books still
Cling by their titles,
And from them creep, as entozoa will,
Into our vitals.
But see! Tait writes in lucid symbols clear
One small equation;
And Force becomes of Energy a mere
Space-variation.

Force, then, is Force, but mark you! not a thing,
Only a Vector;
Thy barbèd arrows now have lost their sting,

Impotent speetre!
Thy reign, O Force! is over. Now no more
Heed we thine action;
Repulsion leaves us where we were before,
So does attraction.

Both Action and Reaction now are gone.
Just ere they vanished,
Stress joined their hands in peace, and made them one;
Then they were banished.
The Universe is free from pole to pole,
Free from all forces.
Rejoice I ye stars—like blessed gods ye roll
On in your courses.

No more the arrows of the Wrangler race,
Piercing shall wound you.
Forces no more, those symbols of disgrace,
Dare to surround you:
But those whose statements baffle all attacks,
Safe by evasion,—
Whose definition, like a nose of wax,
Suits each occasion,—

Whose unreflected rainbow far surpassed
All our inventions,
Whose very energy appears at last
Scant of dimensions:—
Are these the gods in whom ye put your trust,
Lordlings and ladies?
The hidden potency of cosmic dust
Drives them to Hades.

While you, brave Tait! who know so well the way
Forces to scatter,
Calmly await the slow but sure decay,
Even of Matter.

James Clerk Maxwell

School Rhymes

O academic muse that hast for long
Charmed all the world with thy disciples' song,
As myrtle bushes must give place to trees,
Our humbler strains can now no longer please.
Look down for once, inspire me in these lays.
In lofty verse to sing our Rector's praise.

The mighty wheel of Time to light has rolled
That golden age by ancient bards foretold.
Minerva now descends upon our land,
And scatters knowledge with unsparing hand;
Long since Ulysses saw the heavenly maid,
In Mentor's form and Mentor's dress arrayed,
But now to Cambrian lands the goddess flies,
And drops in Williams' form from out the skies;
And as at dawn the brilliant orb of light,
With his bright beams dispels the gloomy night,
So sunk in ignorance our land he finds,
But with his learning drives it from our minds,
And he, a hero, shall with joyful eyes
See crowds of heroes all around him rise;
With great Minerva's wisdom he shall rule
Those boisterous youths—the rector's class at school,
And when in the fifth class begins his power,
And he begins to teach us, from that hour
Dame Poetry begins to show her face,
And witty epigrams the plaster grace;
There growing wild are often to be seen
The names of boys that Duxes erst have been,
And at the chimney-piece is seen the same
All thickly scribbled with the boobie's name.

.

Ne'er shall the dreadful tawse be heard again,
The lash resounding, and the cry of pain;
Carmichael's self will change (O that he would!)
From the imperative to wishing mood;
Ye years roll on, and haste the expected time

When flogging boys shall be accounted crime.

But come, thy real nature let us see,
No more the rector but the goddess be,
Come in thy might and shake the deep profound,
Let the Academy with shouts resound,
While radiant glory all thy head adorns,
And slippers on thy feet protect thy corns;
O may I live so long on earth below,
That I may learn the things that thou dost know!
Then will I praise thee in heroic verse
So good that Linus' will be counted worse;
The Thracian Orpheus never will compare
With me, nor Dods that got the prize last year.
But stay, O stay upon this earth a while,
Even now thou seest the world's approving smile,
And when thou goest to taste celestial joys,
Let thy great nephew teach the mourning boys,
Then mounting to the skies upon the wind,
Lead captive ignorance in chains behind.

James Clerk Maxwell

Seventh Ode Of The Fourth Book Of Horace

All the snows have fled, and grass springs up on the meadows,
And there are leaves on the trees;
Earth has changed her looks, and turbulent rivers decreasing,
Slowly meander along;
Now, with the naked nymphs and her own twin sisters, Aglaïa
Gracefully dances in time.
But the Year, and the Hours which hurry along our existence,
Solemnly warn us to die.
Zephyr removes the frost, and Summer, soon destined to perish,
Treads in the footsteps of Spring,
After the joyous reign of Autumn, abounding in apples,
Shivering Winter returns.
Heavenly waste is repaired by the moon in her quick revolutions
But when we go to the grave,
Beside the pious Æneas, and rich old Tullus, and Ancus,
We are but dust and a shade.
Who knows if the gods above have determined whether to-morrow
We shall be living or dead.
Nothing will come to the greedy hands of your spendthrift successor
Which you have given away.
When you are gone to the grave, and Minos, sitting in judgment,
Utters your terrible doom,
Neither your rank nor your talents will bring you to life, O Torquatus,
Nor will affection avail;
Even the chaste Hippolytus was not released by Diana
From the infernal abyss,
Nor could Theseus break from his friend the rewards of presumption
Which the stern monarch imposed.

James Clerk Maxwell

Song Of The Cub

I know not what this may betoken,
That I feel so wondrous wise;
My dream of existence is broken
Since science has opened my eyes.
At the British Association
I heard the President's speech,
And the methods and facts of creation
Seemed suddenly placed in my reach.

My life's undivided devotion
To Science I solemnly vowed,
I'd dredge up the bed of the ocean,
I'd draw down the spark from the cloud.
To follow my thoughts as they go on,
Electrodes I'd place in my brain;
Nay, I'd swallow a live entozoon,
New feelings of life to obtain.

O where are those high feasts of Science?
O where are those words of the wise?
I hear but the roar of Red Lions,
I eat what their Jackal supplies.
I meant to lie so scientific,
But science seems turned into fun;
And this, with his roaring terrific,
That old red lion bath done.

James Clerk Maxwell

Song Of The Edinburgh Academician

If ony here has got an ear,
He'd better tak' a haud o' me,
Or I'll begin, wi' roarin' din,
To cheer our old Academy.

Dear old Academy,
Queer old Academy,
A merry lot we were, I wot,
When at the old Academy.

There's some may think me crouse wi' drink,
And some may think it mad o' me,
But ither some will gladly come
And cheer our old Academy.

Some set their hopes on Kings and Popes,
But, o' the sons of Adam, he
Was first, without the smallest doubt,
That built the first Academy.

Let Pedants seek for scraps of Greek,
Their lingo to Macadamize;
Gie me the sense, without pretence,
That comes o' Scots Academies.

Let scholars all, both grit and small,
Of Learning mourn the sad demise;
That's as they think, but we will drink
Good luck to Scots Academies.

James Clerk Maxwell

Specimen Of Translation From The Ajax Of Sophocles

O had he first been swept away,
Through air by wild winds tossed,
Or sunk from Heaven's ethereal ray,
To Pluto's dreary coast.
Who trained the Grecians to the field,
Taught them the sword, the spear to wield,
And steeled the gentle mind!
Hence toil gives birth to toil again,
Hence carnage stains the ensanguined plain,
For he destroyed mankind.

Nor the brow with chaplets bound,
Breathing balmy odours round,
Nor the social glow of soul,
Kindling o'er the generous bowl,
Nor the dulcet strain that rings
Jocund from the sounding strings,
Nor endearing love's delight,
Which with rapture fills the night,
Me will he permit to prove,
He, alas! hath murdered love.
But neglected here I lie,
Open to the inclement sky;
And my rough and matted hair
Drinks the dews of night's moist air,
Memorials sad of Troy.
Yet till now, when pale affright
Rolled her hideous form through night
Great in arms, thy shield to oppose,
Ajax at his rampire rose,
And my terror was no more.
Now the hero I deplore,
To the gloomy god consigned,
Now, what joy can touch the mind?
O that on the pine-clad brow,
Darkening o'er the sea below,
Where the cliffs of Sunium rise,
Rocky bulwarks to the skies,
I were placed—with sweet address

Sacred Athens would I bless,
And feel a social joy.

James Clerk Maxwell

The Death Of Sir James, Lord Of Douglas

*"Men may weill wyt, thouch nane thaim tell,
How angry for sorow, and how fell,
Is to tyne sic a Lord as he
To thaim that war off hys mengye.'*

- Barbour's Bruce, B. XX. i. 507.

Where rich Seville's proud turrets rise
A foreign ship at anchor lies;
The pennons, floating in the air,
Proclaim that one of rank is there—
The Douglas, with a gallant band
Of warriors, seeks the Holy Land.
But wherefore now the trumpet's bray,
The clang of arms and war's array,
The atabal and martial drum?
The Moor—the infidel is come;
And there is Sultan Osmyn—see!
With all his Paynim chivalry;
And they have sworn to glut their steel
With the best blood of fair Castile.
"And do we here inactive stand?"
The Douglas cries; "Land! comrades, land!"
Then for the Christian camp he makes,
When thus Alphonso silence breaks:
"What news from Scotland do you bring;
And where is now your patriot king?"
"Alas! within this casket lies
The heart so valiant, good, and wise,
This to the Holy Land we bear,
For we have sworn to lay it there.
But let us forward to the fight,
And God protect the Christian right!"
To whom Alphonso—"Scottish lord,
That now for Spain cost draw that sword,
The terror of thy English foes,
When for her freedom Scotland rose;
With knights like thee and thy brave band

We'll drive the Moslem from the land."
The Douglas thus his comrades cheers—
"Be brave! and as for him that fears,
Let the base coward turn and fly,
For we will gain the day, or die.
Now couch the trusty Scottish spear,
And think King Robert's heart is here,
And boldly charge—already, see
The dogs of Moslems turn and flee."
At the first onset, with the slain
Those valiant warriors strew the plain;
But, hark! the Allah Hu! the foes
Rally, and hot the combat grows,
For here the Spaniards yield, and there
The Moors have slain the brave St. Clair.
Then, midst the thickest of his foes,
The precious casket Douglas throws—
"Pass on before us" hear him cry,
"For I will follow thee, or die."
He rushes on—but all in vain,
For thicker comes the arrowy rain;
And now, by multitudes opprest,
With many a wound upon his breast,
Where 'midst the slain the casket lies,
A noble death the Douglas dies.

James Clerk Maxwell

The Vampyre

Thair is a knichte rydis through the wood,
And a doughty knichte is tree,
And sure hee is on a message sent,
He rydis see hastilie.
Hee passit the aik, and hee passit the birk,
And hee passit monie a tre,
Bot plesant to him was the saugh sae slim,
For beneath it hee did see
The boniest ladye that ever he saw,
Scho was see schyn and fair.
And there scho sat, beneath the saugh,
Kaiming hir gowden hair.
And then the knichte—"Oh ladye brichte,
What chance hes brought you here,
But say the word, and ye schall gang
Back to your kindred dear."
Then up and spok the Ladye fair—
"I have nae friends or kin,
Bot in a littel boat I live,
Amidst the waves' loud din."
Then answered thus the douchty knichte—
"I'll follow you through all,
For gin ye bee in a littel boat,
The world to it seemis small."
They gaed through the wood, and through the wood
To the end of the wood they came:
And when they came to the end of the wood
They saw the salt sea faem.
And then they saw the wee, wee boat,
That daunced on the top of the wave,
And first got in the ladye fair,
And then the knichte sae brave;
They got into the wee, wee boat,
And rowed wi' a' their micht;
When the knichte sae brave, he turnit about,
And lookit at the ladye bricht;
He lookit at her bonie cheik,
And hee lookit at hir twa bricht eyne,
Bot hir rosie cheik growe ghaistly pale,

And scho seymit as scho deid had been.
The fause fause knichte growe pale wi frichte,
And his hair rose up on end,
For gane-by days cam to his mynde,
And his former luv he kenned.
Then spake the ladye,—"Thou, fause knichte,
Hast done to mee much ill,
Thou didst forsake me long ago,
Bot I am constant still;
For though I ligg in the woods sae cald,
At rest I canna bee
Until I sucke the gude lyfe blude
Of the man that gart me dee."
Hee saw hir lipps were wet wi' blude,
And hee saw hir lyfelesse eyne,
And loud hee cry'd, "Get frae my syde,
Thou vampyr corps uncleane!"
Bot no, hee is in hir magic boat,
And on the wyde wyde sea;
And the vampyr suckis his gude lyfe blude,
Sho suckis hym till hee dee.
So now beware, whoe're you are,
That walkis in this lone wood;
Beware of that deceitfull spright,
The ghaist that suckle the blude.

James Clerk Maxwell

To F.W.F.

Farrar, when o'er Goodwin's page
Late I found thee poring,
From the hydrostatic Sage
Leaky Memory storing,
Or when groaning yesterday
Needlessly distracted
By some bright erratic ray,
Through a sphere refracted,—

Then the quick words, oft suppressed,
In my fauces fluttered;
Thoughts not yet in language drest
Pleasing to be uttered.
He that neatly gilds the pill
Hides the drug but vainly,
So, in chance-sown words, I will
Speak the matter plainly.

Men there are, whose patient minds,
In one object centred,
Wait, till through their darkened blinds
Truth has burst and entered.
Then, that ray so barely caught
Joyfully absorbing,
They behold the realms of Thought
Into Science orbiting.

Thus they wait, and thus they toil,
Thus they end in knowing,
Like good seed in kindly soil
Taking root and growing.
Men there are whose ambient souls,
In rapt Intuition,
Seize Creation as it rolls,
Whole, without partition.

Not for them the darkened room,
Lens, and perforation;
Enemies are they to gloom,

Foes to Insulation.
Theirs the light of perfect Day,
Theirs the sense of Freedom;
Dungeons, and the tortured ray,
Serve for those that need 'em.

Song to them of right belongs,
Eloquently flowing;
Sweeping down time-honoured wrongs,
Surging, burning, glowing.
Songs in which all hearts rejoice,
Songs of ancient story;
Songs that fill a People's voice
Marching on to glory.

Thus they live, and thus they love,
Thus they soar in singing;
Like glad larks in heaven above,
Dazzling courses winging.—
Here, I prithee, turn thy mind
To a little fable
Of the fledged and rooted kind,
Bird and vegetable.

Pensive in his lowly nest
Once a Lark was lying;
Often did he heave his breast
Querulously sighing.
For he saw with envious eyes,
Pampered vegetation—
Cabbages of goodly size,
Swoll'n with emulation.

Till their self-infolded green
Tight crammed, wide distended,
Seemed in sphered pomp to mean
All that it pretended.
Long he sought to win their place
In the Gardener's favour;
Well he caught the silent grace
Of a plant's behaviour.

All was useless, he confest,
Earth for him unsuited;
Terror seized upon him, lest
He should there be rooted.
"Cabbages are cabbages,
Larks are larks," he muttered;
Then, light springing in the breeze,
Through the sky he fluttered.

Farrar, mark my fable well,
Fling away Ambition;
By that sin the angels fell
Into black perdition.
Cut the Calculus, and stop
Paths that lead to error;
Think—below the Junior Op.,
Gapes the Gulph's grim terror.

Then your Mathematic wings,
Plucked from off your shoulder,
Will express what Horace sings
Of that rash youth, bolder
Than his waxen wings allowed,
Or his cautious father.
Fall not thou from out thy cloud
Algebraic, rather

Try the Poll, for none but fools,—
Fools, I mean, at College,
Reach the earth between two stools,
Triposes of Knowledge.
Better in poetic rage
Sing, through heaven soaring,
Than disfigure Goodwin's page
By incessant poring.

James Clerk Maxwell

To Hermann Stoffkraft, Ph.D., The Hero Of A Recent Work Called Paradoxical Philosophy

A paradoxical ode, after Shelley.

I.

My soul is an entangled knot,
Upon a liquid vortex wrought
By Intellect, in the Unseen residing,
And thine cloth like a convict sit,
With marlinspike untwisting it,
Only to find its knottiness abiding;
Since all the tools for its untying
In four-dimensioned space are lying
Wherein thy fancy intersperses
Long avenues of universes,
While Klein and Clifford fill the void
With one finite, unbounded homaloid,
And think the Infinite is now at last destroyed.

II.

But when thy Science lifts her pinions
In Speculation's wild dominions,
We treasure every dictum thou emittest,
While down the stream of Evolution
We drift, expecting no solution
But that of the survival of the fittest.
Till, in the twilight of the gods,
When earth and sun are frozen clods,
When, all its energy degraded,
Matter to æther shall have faded;
We, that is, all the work we've done,
As waves in æther, shall for ever run
In ever-widening spheres through heavens beyond the sun.

III.

Great Principle of all we see,
Unending Continuity!
By thee are all our angles sweetly rounded,
By thee are our misfits adjusted,
And as I still in thee have trusted,
So trusting, let me never be confounded!
Oh never may direct Creation
Break in upon my contemplation;
Still may thy causal chain, ascending,
Appear unbroken and unending,
While Residents in the Unseen—
Æons and Emanations—intervene,
And from my shrinking soul the Unconditioned screen.

James Clerk Maxwell

To K.M.D.

In the buds, before they burst,
Leaves and flowers are moulded;
Closely pressed they lie at first,
Exquisitely folded.

Though no hope of change they felt,
Folded hard together,
Soon their sap begins to melt
In the warmer weather.

Till, when Life returns with Spring,
Through them softly stealing,
All their freshness forth they fling,
Hidden forms revealing. [606]

Who can fold those flowers again,
In the way he found them?
Or those spreading leaves restrain,
In the buds that bound them?

Trust me, Spring is very near,
All the buds are swelling;
All the glory of the year
In those buds is dwelling.

What the opened buds reveal
Tells us—Life is flowing;
What the buds, still shut, conceal,
We shall end in knowing.

Long I lingered in the bud
Doubting of the season,
Winter's cold had chilled my blood—
I was ripe for treason.

Now no more I doubt or wait,
All my fears are vanished,
Summer's coming, dear, though late,
Fogs and frosts are banished.

James Clerk Maxwell

To My Wife

Oft in the night, from this lone room
I long to fly o'er land and sea,
To pierce the dark, dividing gloom,
And join myself to thee.

And thou to me wouldst gladly fly,
I know thee well, my own true wife!
We feel, that when we live not nigh,
We lose the crown of life.

Yet soon I hope, at dead of night,
To meet where all is strange beside,
And mid the train's resounding flight
To have thee by my side.

Then shall I feel that thou art near,
Joined hand to hand and soul to soul;
Short will that happy night appear,
As through the dark we roll.

Then shall the secret of the will,
That dares not enter into bliss;
That longs for love, yet lingers still,
Be solved in one long kiss.

I, drinking deep of thy rich love,
Thou feeling all the strength of mine,
Our souls will rise in faith above
The cares which make us pine.

Till I give thee, thou giving me,
As that which either loves the best,
To Him that loved us both, that He
May take us to His rest.

Wandering and weak are all our prayers,
And fleeting half the gifts we crave;
Love only, cleansed from sins and cares,
Shall live beyond the grave.

Strengthen our love, O Lord, that we
May in Thine own great love believe
And, opening all our soul to Thee,
May Thy free gift receive.

All powers of mind, all force of will,
May lie in dust when we are dead,
But love is ours, and shall be still,
When earth and seas are fled.

James Clerk Maxwell

To The Additional Examiner For 1875

Queen Cram went straying
Where Tait was swaying,
In just hands weighing,
With care immense,
Dry proofs made pleasant
By Routh or Besant
For one who hasn't
Got too much sense.
Nor marked how, quicker
Than mounts the liquor
In brains made thicker
By College beer,
The murderous maiden,
Mistake, walks laden
With tips forgotten and slips so queer.

How, like a spider,
She still spreads wider,
O'er bookwork, rider,
And problem too,
Her flimsy curtain
Of terms uncertain,
Till all seems dirt in
The marker's view.
For if Cram were not,
Which markers spare not,
Wise men would care not
To pluck too soon,
Seeing all life's season
Of budding reason
Finds good stiff work for a wooden spoon.

As Tait sat joking,
And marked while smoking,
Still slyly poking
Where jests might hit,
She came, soft-gliding,
Her false face hiding,
Rich food providing

For Tait's sharp wit.
Through symbols tangled,
The Wranglers wrangled
Like sweet bells jangled
And out of tune.
For though their music
Would soon make you sick
The tides they measure and guide the moon.

Cram found no cover
Wherein to hover,
For still above her
Tait held his pen,
Which, onward creeping,
Might find her sleeping,
But left her weeping
O'er ruined men.
For, like a blister,
Mistake, Cram's sister,
Would wring and twist her
In awkward ways,
Till all the knowledge
Acquired at College
Had passed from thought(49) in the last six days.

James Clerk Maxwell

To The Air Of Lorelei

I.

Alone on a hillside of heather,
I lay with dark thoughts in my mind,
In the midst of the beautiful weather
I was deaf, I was dumb, I was blind.
I knew not the glories around me,
I counted the world as it seems,
Till a spirit of melody found me,
And taught me in visions and dreams.

II.

For the sound of a chorus of voices
Came gathering up from below,
And I heard how all Nature rejoices,
And moves with a musical flow.
O strange! we are lost in delusion,
Our ways and doings are wrong,
We are drowning, in wilful confusion,
The notes of that wonderful song.

III.

But listen, what harmony holy
Is mingling its notes with our own!
The discord is vanishing slowly,
And melts in that dominant tone.
And they that have heard it can never
Return to confusion again,
Their voices are music for ever,
And join in the mystical strain.

IV.

No mortal can utter the beauty

That dwells in the song that they sing;
They move in the pathway of duty,
They follow the steps of their King.
I would barter the world and its glory,
That vision of joy to prolong,
Or to hear and remember the story
That lies in the heart of their song.

James Clerk Maxwell

To The Chief Musician Upon Nabra: A Tyndallic Ode

I.

I come from fields of fractured ice,
Whose wounds are cured by squeezing,
Melting they cool, but in a trice,
Get warm again by freezing.
Here, in the frosty air, the sprays
With fernlike hoar-frost bristle,
There, liquid stars their watery rays
Shoot through the solid crystal.

II.

I come from empyrean fires --
From microscopic spaces,
Where molecules with fierce desires,
Shiver in hot embraces.
The atoms clash, the spectra flash,
Projected on the screen,
The double D, magnesian b,
And Thallium's living green.

III.

We place our eye where these dark rays
Unite in this dark focus,
Right on the source of power we gaze,
Without a screen to cloak us.
Then where the eye was placed at first,
We place a disc of platinum,
It glows, it puckers! will it burst?
How ever shall we flatten him!

IV.

This crystal tube the electric ray

Shows optically clean,
No dust or haze within, but stay!
All has not yet been seen.
What gleams are these of heavenly blue?
What air-drawn form appearing,
What mystic fish, that, ghostlike, through
The empty space is steering?

V.

I light this sympathetic flame,
My faintest wish that answers,
I sing, it sweetly sings the same,
It dances with the dancers.
I shout, I whistle, clap my hands,
And stamp upon the platform,
The flame responds to my commands,
In this form and in that form.

VI.

What means that thrilling, drilling scream,
Protect me! 'tis the siren:
Her heart is fire, her breath is steam,
Her larynx is of iron.
Sun! dart thy beams! in tepid streams,
Rise, viewless exhalations!
And lap me round, that no rude sound
May max my meditations.

VII.

Here let me pause. -- These transient facts,
These fugitive impressions,
Must be transformed by mental acts,
To permanent possessions.
Then summon up your grasp of mind,
Your fancy scientific,
Till sights and sounds with thought combined,

Become of truth prolific.

VIII.

Go to! prepare your mental bricks,
Fetch them from every quarter,
Firm on the sand your basement fix
With best sensation mortar.
The top shall rise to heaven on high --
Or such an elevation,
That the swift whirl with which we fly
Shall conquer gravitation.

James Clerk Maxwell

To The Committee Of The Cayley Portrait Fund

O wretched race of men, to space confined!
What honour can ye pay to him, whose mind
To that which lies beyond hath penetrated?
The symbols he hath formed shall sound his praise,
And lead him on through unimagined ways
To conquests new, in worlds not yet created.

First, ye Determinants! in ordered row
And massive column ranged, before him go,
To form a phalanx for his safe protection.
Ye powers of the n th roots of -1 !
Around his head in ceaseless cycles run,
As unembodied spirits of direction.

And you, ye undevelopable scrolls!
Above the host wave your emblazoned rolls,
Ruled for the record of his bright inventions.
Ye Cubic surfaces! by threes and nines
Draw round his camp your seven-and-twenty lines—
The seal of Solomon in three dimensions.

March on, symbolic host! with step sublime,
Up to the flaming bounds of Space and Time!
There pause, until by Dickenson depicted,
In two dimensions, we the form may trace
Of him whose soul, too large for vulgar space,
In n dimensions flourished unrestricted.

James Clerk Maxwell

Torto Volitans Sub Verbere Turbo Quem Pueri Magno In Gyro Vacua Atria Circum Intenti Ludo Exercent

Of pearies and their origin I sing:
How at the first great Jove the lord of air
Impelled the planets round the central sun
Each circling within each, until at last
The winged Mercury moves in molten fire.
And which of you, ye heavenly deities,
That hear the endless music of the spheres,
Hast given to man the secret of the Top?
Say, was it thou, O Fun, that dost prefer,
Before all temples, liberty and play?
Yes, yes, 'twas only thou, thou from the first
Wast present when the Roman children came
To the smooth pavement, where with heavy lash
They chased the wooden plaything without end. [580]
But not to tell of these is now my task,
Nor yet of humming-tops, whose lengthened neck,
With packthread bound, and handle placed above,
Amuses little children. Not of these,
But of the pearie, chief of all his tribe,
Do I now sing. He with a sudden bound
From out his station in the player's hand
Descends like Maia's son, on one foot poised,
And utters gentle music circling round,
Till in the centre of the ring it sleeps.
When lo, as in the bright blue vault of heaven
A falcon, towering in his pride of place
Perceives from far a partridge on the wing,
And stoops to seize him, even so comes down
Another pearie, and as when the sword
Of faithful Abdiel struck the apostate's crest
And "sent him reeling back ten paces huge,"
So reeled the former pearie, nor can stand
The latter's iron peg, and more come down;
Innumerable hosts of pearies, armed
With dire destructive steel. The players shout;
It is the shout of battle; the loud cry
Of victors rushing to the spoil; the wail

Of ruined boys, their pearie split, and all,
All lost.
Thus wags this ever-changing world,
And we may morals from the pearie draw.

James Clerk Maxwell

Tune, Il Segreto Per Esser Felice

I.

There are some folks that say,
They have found out a way,
To be healthy and wealthy and wise—
"Let your thoughts be but few,
Do as other folk do,
And never be caught by surprise.
Let your motto be—Follow the fashion,
But let other people alone;
Do not love them, nor hate them, nor care for their fate,
But keep a look out for your own.
Then what though the world may run riot,
Still playing at catch who catch can;
You may just eat your dinner in quiet,
And live like a sensible Man."

II.

'Twere a beautiful thing,
Thus to sit like a king,
And talk of the world turning round,
If it were not that we
Like all things that we see,
Are standing on moveable ground.
While we boast of our tranquil enjoyments,
The means of enjoyment are flown,
Both our joys and our pains, till there's nothing remains,
But the tranquil repose of a stone.
The world may be utterly crazy,
And life may be labour in vain;
But I'd rather be silly than lazy,
And would not quit life for its pain.

III.

In Nature I read

Quite a different creed,
There everything lives in the rest;
Each feels the same force,
As it moves in its course,
And all by one blessing are blest.
The end that we live for is single,
But we labour not therefore alone,
For together we feel how by wheel within wheel,
We are helped by a force not our own
So we flee not the world and its dangers,
For He that has made it is wise,
He knows we are pilgrims and strangers,
And He will enlighten our eyes.

James Clerk Maxwell

Valedictory Address To The D--N

John Alexander Frere, John,
When we were first acquaint,
You lectured us as Freshmen
In the holy term of Lent;
But now you're gettin' bald, John,
Your end is drawing near,
And I think we'd better say "Goodbye,
John Alexander Frere."

John Alexander Frere, John,
How swiftly Time has flown!
The weeks that you refused us
Are now no more your own;
Tho' Time was in your hand, John,
You lingered out the year,
That Grace might more abound unto
John Alexander Frere.

There's young Monro of Trinity,
And Hunter bold of Queen's,
Who spurn the chapel system,
And "vex the souls of Deans."
But all their petty squabbles
More ludicrous appear,
When we muse on thy departed form,
John Alexander Frere.

There's many better man, John.
That scorns the scoffing crew,
But keeps with fond affection
The notes he got from you—
"Why he was out of College,
Till two o'clock or near,
The Senior Dean requests to know,
Yours truly, J. A. Frere."

John Alexander Frere, John,
I wonder what you mean
By mixing up your name so

With me, and with "The Dean."
Another Don may dean us,
But ne'er again, we fear,
Shall we receive such notes as yours,
John Alexander Frere.

The Lecture Room no more, John,
Shall hear thy drowsy tone,
No more shall men in Chapel
Bow down before thy throne.
But Shillington with meekness,
The oracle shall hear,
That set St. Mary's all to sleep—
John Alexander Frere.

Then once before we part, John,
Let all be clean forgot,
Our scandalous inventions,
[Thy note-lets, prized or not].
For under all conventions,
The small man lived sincere,
The kernel of the Senior Dean,
John Alexander Frere.

James Clerk Maxwell

Valentine By A Telegraph Clerk

The tendrils of my soul are twined
With thine, though many a mile apart.
And thine in close coiled circuits wind
Around the needle of my heart.

Constant as Daniel, strong as Grove.
Ebullient throughout its depths like Smee,
My heart puts forth its tide of love,
And all its circuits close in thee.

O tell me, when along the line
From my full heart the message flows,
What currents are induced in thine?
One click from thee will end my woes.

Through many a volt the weber flew,
And clicked this answer back to me;
I am thy farad staunch and true,
Charged to a volt with love for thee.

James Clerk Maxwell

Why, When Our Sun Shines Clearest

Why, when our sun shines clearest,
Why, when our hopes seen nearest,
Why, when our life feels dearest,
Rises a secret pain—
Hope's perfect mirror broken—
Shadows of things unspoken—
Why will not some sure token
Calm us to rest again?

Mixed with all earthly blessing
Lingers the fear distressing—
-Conscience within confessing
Nothing of ours is pure.
Still must such thoughts upbraid us,
Seeking our own to aid us;
God, not ourselves, hath made us;
Trusting in Him we're sure.

Thus, from our sorrows gleaning
Thoughts of the world's deep meaning,
Let us rejoice while leaning
Firm on our Father's arm.
Now are we one for ever,
Joined so that none may sever,
Souls, so united, never
Faint through mischance or harm.

James Clerk Maxwell

Will You Come Along With Me?

I.

Will you come along with me,
In the fresh spring-tide,
My comforter to be
Through the world so wide?
Will you come and learn the ways
A student spends his days,
On the bonny, bonny braes
Of our ain burnside?

II.

For the lambs will soon be here,
In the fresh spring-tide;
As lambs come every year
On our ain burnside.
Poor things, they will not stay,
But we will keep the day
When first we saw them play
On our ain burnside.

III.

We will watch the budding trees
In the fresh spring-tide,
While the murmurs of the breeze
Through the branches glide.
Where the mavis builds her nest,
And finds both work and rest,
In the bush she loves the best,
On our ain burnside.

IV.

And the life we then shall lead

In the fresh spring-tide,
Will make thee mine indeed,
Though the world be wide.
No stranger's blame or praise
Shall turn us from the ways
That brought us happy days
On our ain burnside.

James Clerk Maxwell