Cambridge Schools Medley 2014

Lettuce in the Closet

We grew lettuce under bright fake sun
The plants all grew except for one
One day they didn't get enough water spray
Those poor plants nearly wilted away
We put them in the closet for about two weeks
It was dark in there and we didn't take a peek
Than that lettuce died.
Every plant, whether lettuce or redwood,
Tulip, moss or nettle
If it's not to end up dead
Should have the right to access a little bit of light
If you hide it in a closet it will lose that fight for life.

Photosynthesong

Through stomata in the leaves,
Carbon dioxide from the air
Reacts with water from the ground
Makes sugar so that there is a store of energy
From the sun the plant can use
Releasing oxygen we breathe or else our lives we lose.
Six CO_2 plus six H_2O in the presence of sunlight
makes $C_6H_{12}O_6$ plus six O_2 when it's bright
Carbon dioxide gas plus liquid water
Plus photons and enzymes with
Chlorophyll's aid give glucose and oxygen
Photosynthesis powered by sunshine
Photosynthesis powered by sunshine

Shadows

What's the difference 'tween a shadow on the Earth and the Moon?
On Earth in your shadow you can see a dead raccoon.
On the Moon in your shadow road-kill disappears
Because on the Moon there is no atmosphere
On the Earth dust and molecules, mist in the air
Scatter photon from the sun nearly everywhere…
Ev'rywhere, ev'rywhere nearly everywhere, ev'rywhere, ev'rywhere
Ev'rywhere, ev'rywhere nearly everywhere,
Ev'rywhere, ev'rywhere, ev'rywhere nearly everywhere,
Ev'rywhere, ev'rywhere nearly everywhere, everywhere.

Lights at Night

Have you ever seen a light at night?
Moon reflects the bright sunlight
Twinkly stars are bright suns so far
But nearby fireflies gleam like stars.

Phases of the Moon

New moon starts with a sliver on the right
Waxing crescent grows silver in the night
First quarter looks like a tasty moon pie
Waxing gibbous swells high in the sky
High in the sky, high in the sky, in the sky,
In the sky, in the night sky.

Full moon shines like a lantern in space
Waning gibbous then takes its place
Third quarter looks like the first reversed
Waning crescent glows pale in our dark, dark universe

These are the phases of our Moon,
Of our Moon in the night sky.

Lights Through the Day

Wake up, see the sun rise from the glowing east
Gas burning orange blue, cooking breakfast feast.
Blinking, flick'ring, flashing lights on firefighter's car
Silvery light shimmering from delicious candy bar.

Red, green and yellow, lights to stop and go
Sunlight on the river, dazzling, sparkling ripples glow
My reflection in the window as a gaze entranced
By diamonds in the jew'lry store making daylight dance

Lights through the day show us the way
From dawn to dusk
But we just take for granted that we see
Though this ability is virtually miraculous. *(repeat this verse)*

Invisible Colors

By Andrea Gaudette

Red and orange yellow green and blue and violet:
Colors in the rainbow human eyes can know.
But there are other colors we can never truly see.

Dorothy and Toto went beyond the rainbow niche,
Spun around in circles, crushed the wicked witch.
Don't you ever wish for colors just like Dorothy?

Ultraviolet lies just beyond the purple hue,
Electromagnetic radiation's shorter waves.
Longer waves are infrared light we cannot see
But we feel as heat.

High:

Sometimes how I wish that I could
See into the dark:
Colors in the spectrum
Beyond the rainbow's arc,
Colors that I cannot reach
Invisible to me.

Red and orange yellow green and
Blue and violet:
Colors in the rainbow
Human eyes can know.
But there are other colors we can
Never truly see.

Low:

Red orange yellow green blue violet
Red orange yellow green blue violet
Red orange yellow
Green blue violet
Red orange yellow
Green blue violet
Red orange yellow
Green blue violet
Red orange yellow green blue violet
Red orange yellow
Green blue violet
Red orange yellow
Green blue violet
Red orange yellow
Green blue violet
Red orange yellow green and blue

The Ballad of Michaelson and Morley

Music by Ruth Hertzman-Miller
Lyrics by Meg Muckenhoupt

All scientists agree, a theory isn't true
Unless you do a test and see if it can be disproved.
And if your theory's wrong, you have to let it go,
And try to make a new one up from all the facts you know.

You keep the best idea, the rest you throw away,
And that is why we celebrate two scientists today.

Chorus:
They were wrong! They were wrong!
They were wrong about the ether they believed in so long,
There was never any ether, so they never could be right,
But Michaelson and Morley helped us see the light.

The ether was a substance, so as the earth would spin
The ether made a current where the light wave had to swim.
They set up light and mirror to send light against the flow,
And the scientists expected that the light wave would be slow.

The mirror was half-silvered so the light beam's other half
Would flow across the ether and be fast, fast, fast.
Two more mirrors would reflect the light beams, one and two,
And from their speeds an interference pattern would ensue.

Chorus:

In the end there was no pattern, and no matter where they'd go
The light waves traveled just the same, there was no fast or slow.
They repeated their experiment and rechecked ev'ry bit,
But they always got the same result, and finally they quit.

Because of their experiment the ether age was through.
They had to seek enlightenment and think of something new.
They wrote three diff'rent papers so that ev'ryone would hear,
And Michaelson and Morley made it very, very clear:

Chorus:

So remember, all you scientists, when ever you feel blue,
It could be that your problem is a theory that's not true.
The ether was a good idea, until it turned out wrong
Because there was no evidence for ether all along.

While Michaelson and Morley may have thought they failed the test,
Their biggest failure was their most spectacular success!

They were right! They were right!
And we'll be forever grateful that they found the speed of light,
When they gave up on ether, there were right as right can be.
They set the stage for Einstein and relativity.

Cosmic Microwave Background

by David Haines

Why should I care about the CMB?
What can that old radiation have to do with me?
What do the dimples from the Big Bangs birth
Offer little me on this bit little Earth?
Three hundred and sev'nty nine thousand years
After Big Bang banged or so I hear
Photons escaped thick plasma fog
No longer trapped in the particle bog.

Refrain:
Cosmic microwave background,
Why should I ever care?
Cosmic microwave background,
How do I know that it's even there? even there? even there?

Thirteen billion years after that and just a little bit more
Penzias and Wilson in nineteen hundred and sixty four
With a Dicke radiometer detected it
The surface of last scattering. Wow! What a hit!
The CMB, as through space it moves,
Turns out to be almost perfectly smooth
But the tiny anisotropies which COBE found
Are the seeds of ev'ry galaxy we see all around.

Refrain:

When the cosmos inflated much quicker than light
Quantum fluctuations in matter though slight
Expanded to fill the cosmos that we know
Just as tiny ripples into sand dunes grow.
That's why I care about the CMB
Without irregularities there'd be no me
Those quantum blips in the primal gloop
Enabled stars and galaxies,
Alice's Adventures in Wonderland and palaces,
Guth and truth and fallacies and veg'table soup.

Refrain: (different)
Cosmic microwave background
Ten thousandth of a degree
That's the difference between
the warm and the cold
But that's the reason there's you, them and he and she
And that teeny little quantum perturbation
Is what led to me! To me! To me!

Doppler Shift

By Tim Maurice

Men:
Night sky, millions of stars trillions of miles away.
Now I wonder how far that starlight has journeyed,
Journeyed today?

All: Science can tell us, lightwaves in motion.

Sop:
Doppler shift is the change in the frequency
Of a wave passing by
When the source is moving closer
Or further away.

All:
Waves of light project from a star
but if that star is moving
then when those lightwaves
arrive on the Earth

Men: Their pattern is diff'rent
Sop: The light waves are changing
Alto: The frequency changes
All: Doppler shift! Doppler shift!

Sop: We can hear the Doppler effect when a train passes by,
Sop & Men: Blowing the horn, the sound source is moving
All: The sound waves expand.

Ahh____ Ahh_____ Ahh____

Waves of sound project from the train,
But since that train is moving,
Then when those sound waves arrive in your ears

Men: Their pattern is diff'rent
Sop: The sounds waves are changing
Alto: The frequency changes

All: Doppler shift! Doppler shift!

Earth's Sweet Song

Music by Daniel Kallman
Lyrics by Christine Kallman

When earth is in balance it's like a sweet song
With millions of creatures all singing along.
The sun sends to Earth mostly visible light;
Our air holds enough heat to keep it just right.
So Earth is in balance from morning till night
And all of us join in the song.

For too many years now we've burned fossil fuels
Upsetting the balance and changing the rules.
The infrared trapped by too much CO_2
Is warming the planet much more than we knew;
Now there's so much to do.

Some day in the future our children will cry:
"Why didn't you listen? Why didn't you try
To take care of the atmosphere, why? Tell me why
Didn't you try back when the earth was in balance,
Just like a sweet song,
When millions of creatures were singing along?
Hmmm____

Green Magic

Music by Michael Ching
Poem by James Patrick Kelly

Long before our age of knowing,
Men tried to change lead into gold,
Turn a dullness into sparkle,
Pluck fairy treasures from thin air.
These old alchemists could not see
The wonder that was all about.
The torrent from the stars above
Did greater magic that their spells.

The leaves sun struck with chlorophyll,
Have ever been our alchemists.
Make CO_2 into O_2
They fix carbon, create our world.
We understand that chemistry,
But not the strangeness of the light,
We cannot know one photon's fate,
It forces us to look askance.
But when the light has had its way,
With chloroplasts and ATP
The common air itself transforms,
To sugared treasures from the sun,
Sugared treasures from the sun,
Sugared treasures from the sun.

Spoken solo:
Yet we do see no more than they,
Those blind old men with tattered books.
We stare at screens, peer through windows
Miss the miracle of the light.

Chorus:
CO_2 H_2O O_2 O_2 O_2 O_2 O_2 O_2 (repeat as often as needed)

Laser

by David Haines

When an atom is excited
An electron is ignited
And it takes a quantum leap to the next level
As its energy decreases
So a photon it releases
And decays back to its ground level where it settles
If another photon strikes the
Atom when it is all feisty
This'll stimulate emission of the photon
All these photons avalanching
And their numbers quick advancing
Make a stream of photons flowing in one direction

Refrain:
This property was studied in a quantum oscillator
This property was harnessed in a laser
Light amplification
By stimulated emission
Of radiation, radiation, radiation

First one built in nineteen sixty
It developed very quickly
A gain medium with an energy supply
There's a mirror at each end of
The gain medium which will send off light
which bounces back and forth between the two.
One mirror's partially transparent
Light escapes and is apparent
As a collimated beam that's pencil-thin
The light emission is coherent
And this property's inherent
To the benefits that lasers in so many ways bring

Refrain:

Coda:
Sop: (throughout) Light amplification, light amplification...
Alto & Ten: (throughout) Stimulated emission of radiation...
Bass: (throughout) Radiation, radiation....

All:
Light amplification by stimulated emission of radiation.

Looking at the Past

By Dan Kohane and Colin Killick

Verse I:

Light's the fastest thing in nature,
See how quickly it will fly
'Round the world to Indonesia
In the blinking of an eye.
Light can bring us information,
Lets us see the way things change.
But although it may seem instant,
we will tell you something strange.
If right this very moment,
the sun just ceased to glow
We'd be finished singing
before anyone would know
'cause even light is bounded,
it can only move so fast.
Watch, see time unfolding,
Looking out is looking at the past.

Verse II:

Light is both a wave and particle
with a color spectrum true.
As it moves further or gets nearer,
Shifts toward red or shifts toward blue.
When we scan the galaxies, we
find that there's a big surprise
Most are red and getting redder,
everywhere throughout the skies
The stars seem to be fleeing,
but that was proven wrong.
The universe is stretching,
has been all along.
Its rate is getting quicker,
All of space is spreading fast,
but we can look and trace it backward
to a pinprick in the past.

Verse III:

Way out in the Bullet cluster
if a telescope sees glow,
if it's strong enough to spot us
this is what the light will show:
A great big ball of rock and fire
with a slowly filling sea,
and four billion years of waiting
'til they get to you and me.

Light's a message in a bottle
that we're certain will arrive,
and every single time we shine it
it leaves proof we were alive.
Those photons, they just keep on flying
and they will arrive at last.
No amount of space can slow them;
Look at them and you can see the past.

ROY G BIV
By Bruce Lazarus

Newton found white light splits up when shining through a prism
and seven colors form the spectrum's base chromaticism.
The colors can be recombined by sending them back through
but try to do the same with paint...you'll need some optimism.

Chorus:
Roy G Biv, While light is bent transformative,
Roy G Biv The colors are consecutive
Roy G Biv It's time to be informative
Red and orange yellow green blue inigo and violet
Roy G Biv The colors of the spectrum
Roy G Biv An acronym that's rather dumb
Roy G Biv Still it helps remember some
Red and orange yellow green blue indigo and violet

Spectroscopes are used to study light from outer space.
Rainbows may be Roy G Biv's most lovely bands of grace
We see spectrums all the time in fountains and lawn sprinklers
But R O Y G B I V is never commonplace.

Chorus:

Some say rainbows end in pots of gold.
True that they're a wonder to behold,
But common sense says there's a hitch,
Would that it were true, we'd all be rich!

Chorus:

Roy G Biv!

Sky Dance

Music by Dan Kallman
Lyrics by Christine Kallman

On a cold, clear night
Our skis swish over the snow-packed fields
To find the open sky.
We have come to see,
Have come to see,
We have come to see the sky dance!

Mischief of sun's enormous rays!
Solar particles trapped in the
Earth's magnetic field
Then drawn to the pole
To scamper and play.
Colliding with gases:
Oxygen, nitrogen, hydrogen, helium.
First a glimmer and a glow of pink,
Then a wash of color:
Green and red and purple and blue
In pulsing, shifting, flashing sheets,
Slashing, turning, roiling and churning,
Filling all the sky
Sometimes impish, leaping flames
Then long green ribbons arcing and twirling,
Swirling through the night!
My heart sings
As I gaze on this dazzling show of light!

On a cold, clear night
Our skis swish over the snow-packed fields
To find the open sky.
We have come to see,
Have come to see,
We have come to see the sky dance!

Straight Lines

by David Haines

Three hundred thousand kilometers
Just in a second that's how far light speeds
One hundred and eight-six thousand miles
Nothing in the cosmos is faster indeed

Look up at the sky on a clear, clear night
Andromeda the galaxy is floating there
Nearly three million years since the
Photons began their lonely journey
From Andromeda into your eye

Whizzing past a massive black hole or star
Light appears to bend….
But light always travels in a straight, straight line
It's really space itself that's curved, my friend
Really space itself that's curved, my friend and…

Light travels in straight lines
Sunlight, lasers, colored or white
Light travels in straight lines
And nothing travels faster than the speed of light
Red, orange, yellow, green and blue,
Indigo and violet too
Rainbow colors are a glorious sight
Mix 'em all together and you'll make white light
White light

Light travels in straight lines
Sunlight, lasers, colored or white
Light travels in straight lines
And nothing travels faster than the speed of light
Light travels in straight lines
Sunlight, lasers, colored or white
Light travels in straight lines
And nothing travels faster than the speed of light
Nothing travels faster than the speed of light
Nothing travels faster than the speed of light.

We Won’t Get Burned

By Lauren Mayer

Hey, it’s great to stay outside
On sunny summer days
But we make sure we don’t get fried
By those ultraviolet rays.

Yeah, to the Earth, the sun sends light
Coming right in our direction,
But it won’t hurt us if we use
The right kind of protection.

We can have fun, fun, fun out in the sun.
So let it shine, shine, shine and we’ll be fine.
Put on plenty of sunscreen,
Head to toe and in between,
And what we’ve learned,
We won’t get burned, we won’t get burned.

The type of rays called UVA
Make you wrinkle like a prune.
UVB’s work invisibly
To make you less immune.

They both cause damage and raise the risk
Of serious melanoma,
So please be careful ev’rywhere
From Maine to Oklahoma.

We can have fun, fun, fun out in the sun.
And though the UVB gives us our vitamin D,
Put on plenty of sunscreen,
Head to toe and in between,
And what we’ve learned,
We won’t get burned, we won’t get burned.

Of course it depends on the time of the year,
And also on which hemisphere,
But always better be wary.
You can even get a sunburn in January.

We got an ozone hole above the North Pole (and the South Pole)
Because of CFC's, we get more UV.
So put on plenty of sunscreen,
Head to toe and in between,
And what we’ve learned,
We won’t get burned, we won’t get burned, we won't get burned.

What Do You See, Butterfly?

Music by Michael Ching
Lyrics by Jennifer L. Knox

What do you see, butterfly? What do you see?
My eyes can see more colors than all other creatures.
Stripes and spots on the wing of my sisters and my brothers,
Glow like stained glass windows ringed in ultra-violet halos.

What do you see little bat? What do you see?
Who said that I am blind? Why that is quite a lie!
My trusty eyes, they gather light from night when there is none!

Part A	*Part B*
Bzz_____ Bzz_____	
Bzz_____ Bzz_____	The microscopic wing of gnats?
Bzz_____ Bzz_____	
Bzz_____ Bzz_____	I swoop on their annoying swarms!

All:
Bzz_____ Bzz_____ Eeee! Hmm, very tasty.

What do you see, cuttlefish? What do you see?
My eyes see three sixty degrees of sea around me.
Though my skin twirls and swirls through the polarized spectrum
Like a twinkling carnival ride, Mm___ Mm___
My salty world is veiled in grey
Ah-----mm-----ah-----mm Ah_____

What do you see, kitty cat? What do you see?
I laugh at you when you are stumbling in the dark! Ow!
The dimmest light still makes the night shine bright to me!
My eyes all black under the couch… Grrrr! Grrrr!
Just like a leopard ready to pounce! Grrrr! Grrrr! Meow!

What's in a Shadow?

By Lauren Mayer

All:
What's in a shadow?
Though it looks spooky late at night,
It's really not a scary sight
To cause you fright,
Not if you know how it's made.

What's in a shadow?
A two-dimensional silhouette,
And even when the sun is set,
You still can get
The type of shadow known as shade.

As you may have seen,
When there's something between
A surface and a source of light,
It makes a dark spot,
A little or a lot,
Depending on the object's shape and height.

Eclipses are shadows,
Phenomena you sometimes see
From astronomical syzygy
(And that just means
Three objects lined up in a row,
But it's a really cool word to know).

There are three diff'rent parts
To a shadow that starts
From a non-point source of light:
Umbra, penumbra,
And antumbra.
See, it's easy to get it right.

So that's what's in a shadow,
How they're formed and how they fall,
Why some are big and some are small,
Some short, some tall.
Aren't you glad you know
What's in a shadow,
What's in a shadow,
What's in a shadow?