A KANGAROO RAILROAD QUIZZ

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RULES OF THE GAME

• Take the test or not, the answers to these questions should be interesting
• Answers may be highly technical or controversial. Sometimes more than one answer will be awarded points.
• The presenter will present his side of the answers.
• Audience is encouraged to justify their objections and opinions but the presenter always has the final decision
• Let’s begin and GOOD LUCK!
What, according to the Association of American Railroads (AAR), is a train?
A train is a **LOCOMOTIVE**, **COUPLED**, with **OR WITHOUT CARS** and **DISPLAYING MARKERS**

You must have all four underlined items to claim 1 point
How many Steam Engines are represented in this picture?
The picture is of a steam locomotive but the question was about steam engines (not the number of locomotives in a class). Remember, an engine is any device that converts energy into useful mechanical motion. Further, a machine can be as simple as an inclined plane, a lever and fulcrum or even a screw. Therefore, this picture represents the following engines

1. Each set of drivers is can be considered a machine
2. Each water injector used to move water from the tender to the boiler
3. The whistle is technically another engine as is the steam generator for the headlight.
4. The power reverse is another engine
5. The screw that delivers coal from the tender to the firebox
6. The pumps for the brakes are machines. The brakes proper are machines too but they do not use steam so they don’t count here.
7. Even the coupler lift pins are a machine to open the couplers.
8. There are more parts that might or might not be considered engines.

(1) Point for each of these 10 items and others up to a maximum of (8) points. There are at least 15 more than listed here
What single special feature is shown in these drawings of two different modern trucks?
1 point if you answered that these were both steerable (or radial) trucks. That type of truck was developed by EMD in 1993. Give yourself 1 more point if you knew the previous pictures were of the later semi-steerable type.

Now, How do they work? Up to (2) more points if you understood these principles (on your honor now).
1/2 point for understanding that railroad wheels are cone-shaped. The centrifugal force of rounding a curve shifts the wheels slightly such that the larger diameter of the outside cone contacts the rail as does the smaller diameter of the inside cone. There would be no friction at all under ideal circumstances, BUT...
1/2 point for knowing that in a conventional truck where the journals are fixed there is always a slight amount of friction because the axle is not exactly square to the rail. Some slippage must occur and is responsible for the constant back and forth sideways motions of a car.
1 point for knowing that the journals in a steering truck (or a semi-steering truck) are allowed to have lateral (horizontal) movement. Springs or some form of shock absorber usually help control this movement.
This graph shows how the distance between journals of a 4-wheel steering truck increases while navigating a curve with only a slight increase of oscillation due to slippage of the wheel tread on the rail.
The Industrial Revolution was alive and well in England. Steam now pumped water from the mines and powered its looms for weaving cloth. The only way to carry goods to market though was by horseback, canals and by foot. So Who built the first steam locomotive?

Hints: He worked with Thomas Newcomen and was employed by James Watt with their two and three story high monstrosities.
William Murdoch was the first to invent a steam powered locomotive in the form of a road vehicle called the Murdoch Flyer in 1784. **3 points** for this answer. Murdoch worked on his road vehicles in his spare time while working for James Watt.

Watt discouraged his efforts because he did not want to lose a valuable employee to help build and maintain his steam engines but there was another reason too.
HINT: How would you miniaturize this “smaller and compact” version of a Watt steam engine to some sort of moving vehicle?
Watt’s engines were all atmospheric engines, that is, the steam pressure was no more than 2 or three psi and depended on condensing steam to drive the pistons. Murdoch’s way of miniaturizing Watt’s huge machines was to use steam pressures in the range of 50 psi. This made the design simpler, faster, lighter and of course way smaller.

2 points. Watt was appalled with such high pressures fearing they could cause explosions so he persuaded his employee to forget his patents and abandon his reckless projects. Murdoch reluctantly agreed but went on to invent the first practical gas lighting
Okay, no tricks now. Who invented the first railroad locomotive? He lived next door to William Murdoch and knew both Thomas Newcomen and JAMES WATT as well. He also built this road-based locomotive shortly after Murdoch’s engine as well. Look carefully at the engine.
1 point for Richard Trevick as the one who invented the first Steam locomotive (Dec 24, 1801). True, the iconic picture of his Pendragon engine shown here had wheels without flanges and ran on a plankway, but it did pull carts of coal over rails (and passengers a bit later) and his later engines had flanged wheels for running on rails.

Now, What was the large wheel for?
Yes, the flywheel did provide inertia for smooth operation but there was a more important reason.

The locomotive had only a single piston which meant that it could not start if the piston was stopped at either end of its stroke. The engineer would have to grab the flywheel and turn it to the point where the valve gear admitted steam to the cylinder to start the engine moving. **Add (2) more points if you got this one right.**

This was common with most small engine of this period until Robert Stevens invented the Rocket.
Who invented and ran the first electric locomotive? (yes, he is in this picture)
That would be Thomas Edison. He was linked to railroads in one way or another for most of his career. He ran his first test of an electric railway in Menlo Park, NJ, on May 13, 18. The locomotive pulled three cars: a flat freight-car, an open awning-car, and a box-car called the "Pullman." One of the innovations of this railway even illustrated a system of electromagnetic braking. General Electric grew out of Edison’s several enterprises.
For you diesel fans, Who was at the throttle of the first MU in public service?
Edison may have been at the throttle of the first *electric* MU (Multiple-Unit) train to depart Lackawanna Terminal in Hoboken in September 1930 (2 points for this) but …

**Frank J. Sprague, formerly employed by Edison,** developed, applied and first tested *pneumatic* MU control on the [South Side Elevated Railroad](http://www.spragueelectric.com) In 1897. (5 points)

Sprague's MU system was adopted for use by *diesel-electric locomotives* and *electric locomotives* in the 1920s. Today's modern MU control utilizes both pneumatic elements for brake control, and electric elements for throttle setting, dynamic braking and fault lights.

Robert C. Sprague, his son, founded Sprague Electric. He invented the tone control for radio and the *paper capacitor* which launched the business which included a large range of electrical devices.
What prominent politician during the mid 1800’s spent a good portion of his life helping the railroads?

- He was a surveyor who helped expand the rails westward.
- He passed legislation for land grants to the trans-continental railroad.
- His rivals said he was a 2-bit surveyor from Sangamon County who had to split rails in his spare time to earn a living.
While Abraham Lincoln was probably best known for freeing the slaves he also played a key role in extending the rails across the country. As a lawyer he took many cases defending the Illinois Central and as president he was a strong advocate of the land grants used to fund the railroads in connecting the East and West coasts of the nation.

He also began his career as a surveyor for the Illinois Central. His surveyor’s chain was a 66’ chain of 100 links. Where did this odd length come from?
2 points if you knew It all started when with King Henry VIII of England wanted to sell the confiscated lands of the Church. He needed a reliable way to define the amount of land being sold to perspective buyers.

2 more points if you knew that an acre was based on oxen plowing a field. A farmer could plow a furrow 1/8 mile or 10 CHAINS long before resting. (note that this ‘furrow’ became known as a ‘furlong’)

The width of 4 trips back and forth worked out to be 16.5 feet or one rod. 4 such areas were a width of 66 feet or one CHAIN; 1/8 mile = 660 feet thus an acre was officially defined as a rectangular strip of land that measured 1 x 10 chains or 1/8 mile long x 66 feet wide.

66 feet * 660 feet = 43,560 square feet or 1 acre.
16.5 ft * 4 = 1 rod; 4 rods = 66 feet or 1 chain.
Plowing this area was considered a good day’s work.

2 more point if you understood that originally chains had nothing to do with laying out curves.
Railroads did help this country to grow but in some cases they abused the environment. The American Red Spruce, for instance was all but decimated thanks to a new type of locomotive. The railroad where this happened is still in existence but it now carries tourists, not lumber. This type of locomotive can still be found all over the world.

Name the locomotive type, the current name of the railroad and the locomotive builder that grew from this prototype.
1 point – The railway is now known as the Cass Scenic railroad.

1 point  The shay gear-driven locomotive became the most common logging locomotive.

(It was invented by Ephraim Shay who went on to convince

2 points LIMA, a manufacturer of farm implements at the time, to build his locomotives.
What is thermite composed of?
When and where was the first welded rail used?
3 points – Thermite, a mixture of aluminum powder and powdered iron oxide (rust), was first used for forge welding rails in 1899, when a number of welded joints were installed in the Essen Tramway (street car system) in Germany.

1 Point - It was used in the UK to weld tram rails installed in Leeds in 1904.

2 points - The first installation of continuous welded rail on a steam railroad main line in the US was on the D&H behind the General Office Building at Albany in 1932,
Code 100 rail is commonly used on layouts but what is the equivalent weight of rail for the prototype?
1 point if you didn’t try to answer this question. You can’t without knowing the scale. The Code is a modeling term and is simply the height of the rail in thousands of an inch regardless of the scale; code 100 rail is simply .100” height.

3 points if you stated **HO scale, 183 lbs AND per yard**. in your answer. This is equivalent to rail which is heavier than any used in the USA although there are some crane rails of that size. In **O scale** it works out to be about a more reasonable 76 lb rail.
Who invented the first inexpensive steel alloy that stood up to years of service under the heaviest of trains even today and where was it first used?

Early rails were first made first from wood and then from pig or cast iron. These all tended to wear and break such that they had to be replaced every three to six months.
½ point if you said George Stevens. His foundry was the first to make rails (above) that would support the locomotives of the day but they were still made from iron, not steel alloy.

3 points if you named Robert Forester Mushet. Steel was well known at the time but it was expensive, could be produced only in small quantities, and was not of consistent quality. Mushet developed an inexpensive way to make high quality steel, by perfecting the Bessemer [blast furnace] process thus Inventing the first commercially produced high quality steel alloy in 1857.

This steel was used instead of iron for the Derby Midland railway station. He also invented both the first true [tungston] tool steel and the first air-hardening steel thru experimentation of steel chemistry.
Rail lengths are made as long as possible, as joints between rails are a source of weakness. Over the decades, lengths increased as manufacturing processes improved.

How long is a standard length or rail as delivered from the mill?
A. Cast or pig iron On the first English railroads.
B. From the civil war until after WWII (about 1950)
C. For welded rail
A. The first cast or pig iron rails from 1825 up to the civil war were about 15 feet long. Fishbelly rails At this point were the equivalent of about 35 lb rail. And laid on stone blocks

B. Between 1860 until 1950 (after WWII) rails were generally made to 39 feet long (limited by the 40’ gondalas used to transport them). Some 78 foot rails (39 * 2) was also produced in the United States.

C. Welded rail after 1950 joined 60’ foot long rails to form continuous rails of 240 feet (4 * 60) and longer in other countries.
What in the world is a Pandrol Clip?
1 point - The Pandrol corporation manufactures a large assortment of those spring-like fasteners used to hold rails in place. The picture was of an insertion machine to install and extract certain types of clips.
What is a 8-degree curve.
3 points - A degree of curvature is legally defined as the central angle $D$ subtended by a chord of 100 feet. The actual radius can be derived from these numbers although it rarely is.

This diagram shows some of the various calculations a surveyor would use to layout a curve. Because the degree of curvature is a whole number, and the chord was a fixed 100’, many surveyors can memorize a certain few various trig functions and do most of the calculations in their head.

1 point - The chain used by surveyors in Lincoln's time was exactly 66 feet. (66’ x 80 = 5280’) and used

Mainlines for passenger service are generally 1 or 2 degrees, Freight service to greater than 6 degrees and trollies greater than 15.

The 24” minimum radius for a model railroad works out to about 33 degrees.
Track gauge, the distance between rails, has always been an important part of railroads. Today, tools to measure this are built into the machines that lay the rails but even so sometimes this must be checked periodically to verify that rails have remained at the proper distance apart. This can be done with tools as simple as the pipe shown above to more sophisticated that can measure distance, slant, sturdiness and a host of other measurements.

We all know the what is the distance between rails at a tangent for standard gauge track but what about curves?

What is the distance between rails for standard gauge track on a 6 degree curve?
The trick to this question is for which era is under consideration.

In the steam era locomotives had a longer wheelbase than today’s diesels. Flanges could ride up on the rails, especially at high speed and rail joints, and cause derailments. To prevent this the gauge was widened on curves to avoid this.

**2 points** if you specified the steam era and almost any widening of the gauge as tables for various roads often published their own tables as to how wide tracks on a curve should be. **Add 1 point more** for knowing The general rule of thumb was to widen the gauge 1/16” for every degree of curve but not to exceed 1” on any curve thus a 6 degree curve would be 4 8-11/16”

**2 points** either way if you specified modern day roads and 4 feet, 8-1/2 inches. Modern steerable trucks on cars and engines do not require a wider gauge and concrete ties provide a fixed distance that can not be altered.
Anyone want to explain THIS? (2 points)
A crew "parked" THREE deisel locomotives coupled together with the forward locomotive “tied down”. Somehow #2 and #3 locomotives were apparently still in gear, and in 4 hours, this is what happened to the rails.

Wheel damage like this is quiet after the first few seconds. As the temperature goes up from the friction, the wheel-rail interface starts to liquefy to molten steel or iron. You can see the plastic deformation on the rail from the excessive heat. Molten iron is a very good lubricant! Once you build up somewhere around 1/32" of liquefied iron, it's the same as pouring cutting oil between the wheel and rail. The wheel is still heating up the rail, but the awful grinding noise you would expect is not there. It is wheel slip, with all six axles spinning in place at about the same speed.
For More Information...

WELDED RAIL  http://www.thermit-welding.com/thermit_welding_process.php
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