**Teacher Comment**

This question is asking for us **to comment on the statement.** Full marks cannot be achieved without answering the question and giving suggestions for why these temperatures are different !

## N5 2015

**4.** A science technician removes two metal blocks from an oven. Immediately after the blocks are removed from the oven the technician measures the temperature of each block, using an infrared thermometer. The temperature of each block is 230 °C.

After several minutes the temperature of each block is measured again. One block is now at a temperature of 123 °C and the other block is at a temperature of 187 °C.

Using your knowledge of physics, comment on possible explanations for this difference in temperature. **3**

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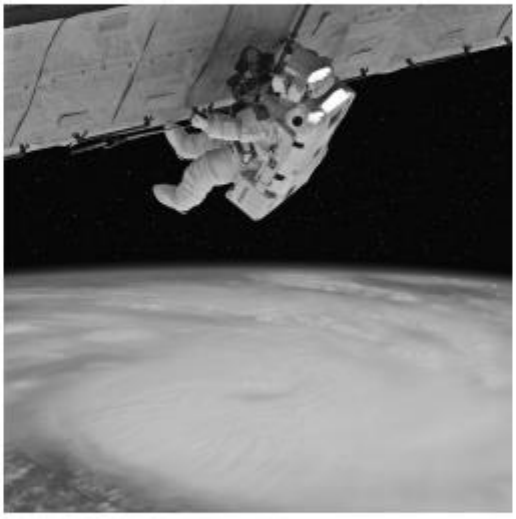
- Blocks may have different specific heat capacities – give definition, provide formula, explain variables.
- Blocks may be made from different materials and therefore the one with a lower specific heat capacity will lose heat more quickly than the block with a higher specific heat capacity.
- Blocks may also have different masses, different surface areas which affect rate of heat loss to surroundings.
- Where are the blocks placed once removed from the oven? Are either of the blocks insulated? One could be losing more heat due to no insulation compared to another.

**10.** Space exploration involves placing astronauts in difficult environments. Despite this, many people believe the benefits of space exploration outweigh the risks.



Using your knowledge of physics, comment on the benefits and/or risks of space exploration. **3**

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- Benefits:
  - Learning more about our home planet, planet Earth. Learning about the future of our home planet through observations of weather, temperature changes, erosion, wild fires etc. Use of satellites to provide this information.

- Developing a knowledge and understanding of the future of the human race – looking for new habitable planets, moons for humans to settle on.
- Advances in technology and materials as a result of space exploration – WD40, fire retardant materials, foam, insulation, Velcro etc.

- Risks:
  - High amount of space junk and increased possibility/risk of high speed collisions with space vehicles/ISS.
  - Cost of space travel – is it worth it?
  - Do we require manned space craft anymore? Dangers to humans in space such as increased exposure to radiation, challenges posed by re-entry.

**N5 2016**

**Teacher Comment**

This question is asking for us **to comment on the statement.** Full marks cannot be achieved without answering the question and **comparing** the two typed of wave!

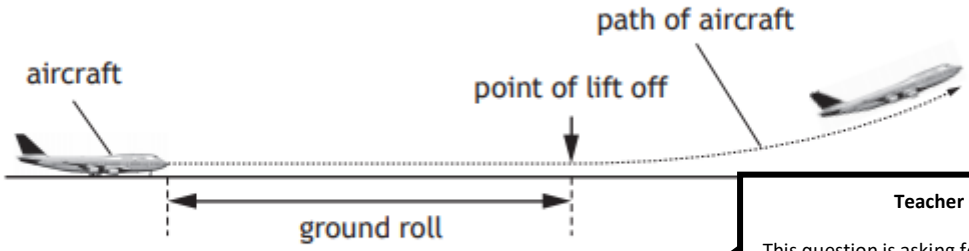
**5.** A Physics textbook contains the following statement.

*"Electromagnetic waves can be sent out like ripples on a pond."*

Using your knowledge of physics, comment on the similarities and/or differences between electromagnetic waves and the ripples on a pond. **3**

- Electromagnetic waves travel at the speed of light ($3 \times 10^8$ $ms^{-1}$) and therefore travel at a much greater speed than water waves.
- They also travel far greater distances than water waves and can travel through a vacuum unlike water waves which require a medium.
- Both Electromagnetic waves and water waves are transverse waves.
- There are seven types of electromagnetic wave, each of which has a different frequency and wavelength compared to the other members of the spectrum.
- The energy of a water ripple dissipates quickly over a relatively short distance compared to that of an electromagnetic wave

11. The length of runway required for aircraft to lift off the ground into the air is known as the ground roll.




The ground roll of an aircraft varies for each take-off.

Use your knowledge of physics to comment on why the ground roll of an aircraft varies for each take-off. 3

**Teacher Comment**

This question is asking for us **to comment on the statement.** Full marks cannot be achieved without answering the question!

- Considering same aircraft under different take-off conditions
- Different conditions such as different mass at take-off, different amount of air resistance. More mass would mean more friction on tyres of aircraft.
- Wear and tear on tyres due to friction would affect aircraft's ability to reach the desired speed for take-off in a certain time and length of runway.
- Volume of fuel would change depending on length of flight which would alter/increase mass of aircraft.
- Greater length of runway would be required to reach desired speed for take-off as mass increases.

**Teacher Comment**

This question is asking for us **to comment on the statement.** Full marks cannot be achieved without answering the question!

**N5 2017**

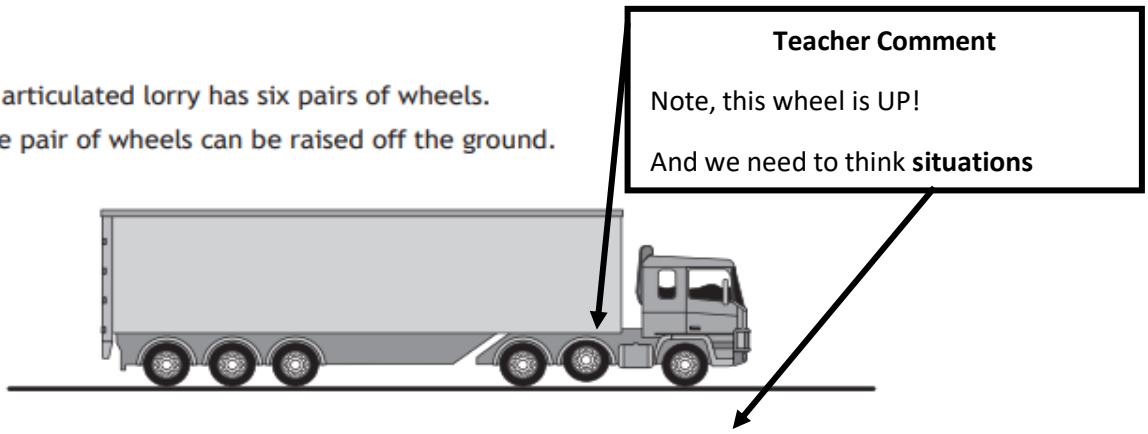
5. Alpha, beta and gamma are types of nuclear radiation, which have a range of properties and effects.

**Using your knowledge of physics,** comment on the similarities and/or differences between these types of nuclear radiation. 3

- All three are ionising radiations and all hail from the nuclei of unstable atoms.
- Whilst all are ionising radiations they are not the same in their make-up: alpha radiation is composed of two protons and two neutrons (helium nucleus), beta radiation is composed of a fast moving electron and gamma radiation travels in the forms of a high frequency electromagnetic wave.
- Alpha radiation is the most ionising and gamma radiation is the least. Alpha is the most ionising due to its considerable size compared to the other two.
- Gamma radiation is the most penetrating while alpha radiation is the least. Alpha radiation can be stopped by a sheet of paper, beta requires a few mm of aluminium and gamma requires a few cm of lead to be stopped (can use diagram to aid explanation).
- Gamma radiation carries considerably more energy compared to alpha and beta.

- Examples of uses: alpha emitting substances are utilised in smoke detectors, beta emitting substances can be used as radioactive tracers in the body and gamma radiation can be used to sterilise medical equipment and treat cancer (any acceptable uses of all three can be used as examples).

**10.** An articulated lorry has six pairs of wheels.
One pair of wheels can be raised off the ground.




**Using your knowledge of physics**, comment on situations in which the wheels may be raised or lowered. **3**

- The horizontal forces on the lorry are represented on this free body diagram:


- Wheels up situations will involve decreasing friction, including:
    - The lorry is not fully loaded
    - Lorry travelling at constant speed
    - Smooth road surface
    - Dry weather
- Wheels down situation when extra friction is required, including:
    - The lorry is fully loaded
    - Lorry required to accelerate
    - Wet/poor weather conditions

# N5 2018

5. A group of students are watching a video clip of astronauts on board the International Space Station (ISS) as it orbits the Earth.

One student states, 'I would love to be weightless and float like the astronauts do on the ISS.'

Using your knowledge of physics, comment on the statement made by the student. 3

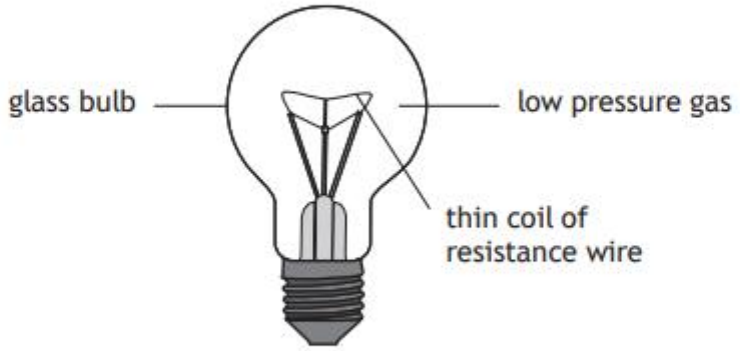
**Teacher Comment**

This question is asking for us **to comment on the statement.** Full marks cannot be achieved without answering the question!

- The student is incorrect as the astronaut is NOT weightless
- The astronaut ***appears*** weightless as they are falling at the same rate as the ISS towards planet Earth – they both have the same vertical acceleration
- This is known as freefall

## N5 2018 continued

7. A filament lamp consists of a thin coil of resistance wire surrounded by a low pressure gas, enclosed in a glass bulb.




Using your knowledge of physics, comment on the suitability of this design as a light source. **3**

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- Due to the current flowing through the resistance wire, electrical energy will be changed to heat energy and light energy.
- Light is only produced as a 'wasted energy' due to the wire becoming very hot. Producing light in this manner is inefficient.
- The low pressure gas is required to increase brightness of the emitted light.
- A more suitable source of light would be an LED which does not produce heat, hence reducing the energy losses.

# N5 2019

3. In 1971, the astronaut Alan Shepard hit a golf ball on the surface of the Moon.

**Teacher Comment**

This question is asking for us **to comment on the similarities and/or differences.**

Full marks cannot be achieved without answering the question!

Using your knowledge of physics, comment on the similarities and/or differences between this event and hitting an identical ball on the surface of the Earth. 3

- The horizontal force applied to the ball is constant. On the Moon the ball will NOT experience air resistance which is different than on the Earth.
    - On Earth air resistance would act as an unbalanced force and the ball would decelerate and not travel as far horizontally on Earth.
    - With no air resistance on the Moon, the ball would travel further.
- The Vertical force applied to the ball is constant. Again, with no air resistance on the Moon the ball will reach a higher vertical height than it would compared to Earth.
- The shape of the flight will look the same on the Moon and the Earth as both are subject to a constant gravitational acceleration, although the parabola on the Moon will be bigger.

13. A physics teacher makes the following statement.

'Instead of nuclear fission, perhaps one day nuclear fusion will become a practical source of generating energy.'

Using your knowledge of physics, comment on the similarities and/or differences between using nuclear fission and nuclear fusion to generate energy.

**Teacher Comment**

A diagram of fission and fusion could also be used

- Nuclear fission involves a Uranium nucleus being split by a neutron. This will cause a chain reaction and more neutrons will be released to go on and split more Uranium. Each splitting released energy. However, the fuel rods (where the uranium is stored) becomes a hazardous waste that lasts a very long time and is hence hard to dispose of.
- Nuclear fusion does not produce dangerous waste products. Although it is a very hard reaction to contact and requires a high energy plasma to facilitate containment
- Fusion is the combining of light nuclear (e.g. Hydrogen) which releases energy.