

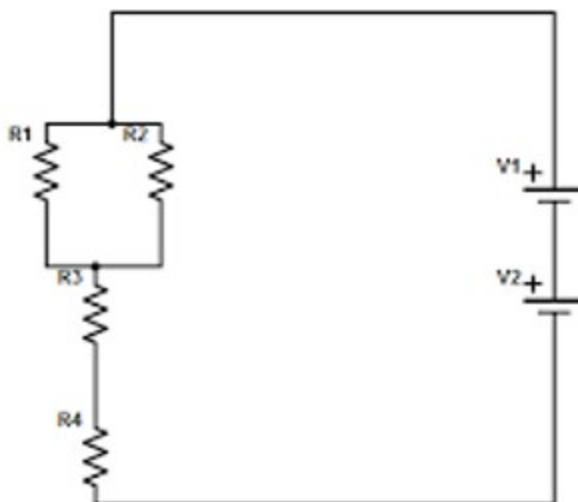
Revision Practice paper

Name:

Date:

Criterion A: Knowing and understanding

Q1. (I) While performing an experiment an MYP 5 student established the following circuit, he wants to use Ohm's law and basic circuitry principles to evaluate various aspects of this circuitry.



- a. If $R_1 = 3\Omega$, $R_2 = 6\Omega$, R_3 and R_4 are 5Ω each, **apply** Ohm's law and circuit concepts to find the total current flowing through the circuit, if the total voltage supplied by the batteries is 20 V. [4]
 - b. Student accidentally touches one of the resistors and finds it hot. **Describe**, the factors and their relationship with heat energy produced that could have given rise to this heat energy? [4]
- (ii) In a birthday party a balloon fell from the wall, Ritu picked up the balloon and rubbed it against her dry hairs and put it back on the wall, surprisingly balloon stuck to the wall, **explain** the electrostatic phenomenon involved that made the balloon cling to the wall. [4]



Image credits: <http://smallscience.club/experiments/hair-raising-electric-balloon/>

- (iii) **Justify** the validity of the statement, “ It is advantageous to connect the household electrical appliances in parallel” [2]
- (iv) The meter reading given below is the consumption of electricity in 1 day (24 hrs) at your house . **Comment** on your power consumption if 1 unit of electricity cost Rs 10. [4]



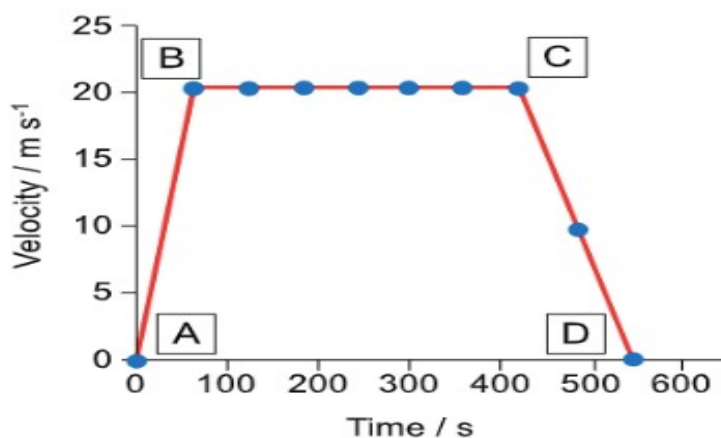
(Image credits: <https://www.npower.com/help-and-support/meter-readings/how-to-read-an-electricity-meter/>)

Q2. Some birds migrate every autumn, some fly to cooler countries and some fly to warmer countries. The bar-tailed godwit in the photograph can fly for nearly 11,000 km without stopping. During the eight-day journey that it takes to cover that distance, the bird doesn't stop for food or rest. This makes the bar-tailed godwit the bird with the longest recorded non-stop flight.



(Image credits: <https://www.smithsonianmag.com/smart-news/bird-designed-jet-fighter-sets-new-record-longest-nonstop-bird-migration-180976078/>)

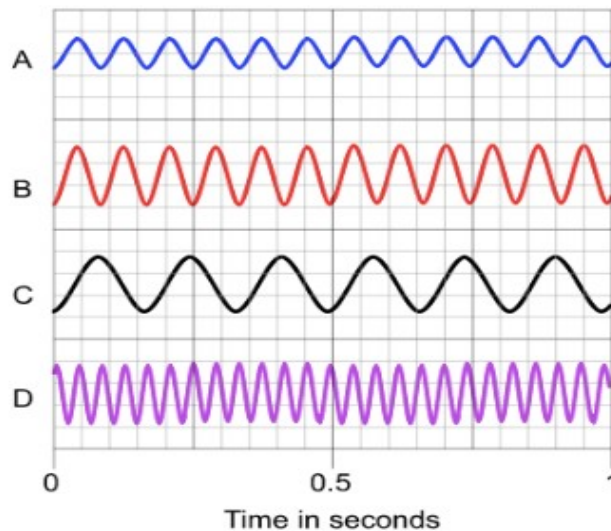
- i. One bar-tailed godwit flies 1200 km in a day. **Calculate** the speed in km/h. [1]
- ii. Scientists fit satellite transmitters to 16 godwits at two locations in New Zealand. Later the scientists use the information from the satellite transmitters and calculate that average speed of the bird is 56 km/h. **Outline** two factors that may affect the average speed achieved by the bar-tailed godwit. [2]
- iii. The graph below shows part of a different migratory bird's journey. **Explain** what is happening with respect to the force, velocity and acceleration of the bird between points C and D on the graph. Include in your explanation which of Newton's law is being obeyed as the graph changes. [4]



- iv. Use the graph to **calculate** the distance travelled by the bird while decelerating. [3]

Q3. Infrasound is a low frequency longitudinal wave that elephants, whales, rhinoceros and alligators use to communicate with each other. The frequency of infrasound waves is lower than 20 Hz. Infrasound waves can travel very long distances through air at a speed of 330 m/s.

Sound waves can be represented on a computer. Below are some waves recorded on a computer from four different sources.



- i. **Calculate** the frequency of wave A. [2]
- ii. **Identify** which two waves have the same frequency. [1]
- iii. **Calculate** the wavelength of wave C. [2]
- iv. Infrasound waves have a frequency of less than 20 Hz. Use your answers above to **identify** which wave does not show infrasound. [1]

Criterion B: Inquiring and Designing

Q4. Joe carries ice cream home from the shops. On hot days, she finds that much of the ice cream has melted before she gets home. She lives 15 minutes away from the shops. Joe decides to investigate a solution to this problem. In many countries, wrapping ice cream in thick paper is an environmentally friendly alternative to insulated bags.

Joe uses standard blocks of ice, each with mass of 100 g, to model the melting of the ice cream. She decides to investigate how the number of sheets of paper wrapped around the block affects the mass of ice that has melted.

- i. Other than ice and paper, **suggest** and **justify** one additional piece of equipment that Joe will need to perform this experiment. [2]
- ii. **Formulate** a testable hypothesis for this experiment. [2]
- iii. **State** one variable that Joe needs to control. **Describe** how and why this variable should be controlled. [2]
- iv. **Identify** independent and dependent variables in situation provided. [2]

v. **Explain** what results Joe needs to collect to ensure that she has sufficient relevant data. [2]

vi. **Design** a logical, complete and safe method that the students may use. You must mention [8]

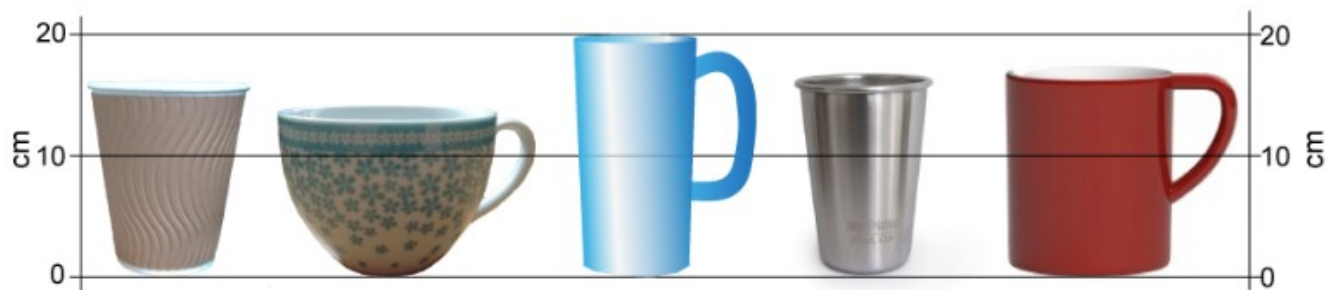
- Appropriate equipment
- Procedure
- Safety measures

Criterion C: Processing and Evaluating

Q5. Another MYP 5 student, Smith, finds that his cup of coffee cools down too quickly when taking it home from his local coffee shop. He wonders if the thin cardboard cup is the reason for the coffee cooling down too quickly.

Smith, formulates the hypothesis,: “The thicker the coffee cup, the longer the coffee will take to cool down because the heat will take longer to transfer through the thicker material of the cup”. He finds cups of different thickness in his kitchen.

He fills each cup with coffee to the same level and times how long it takes for the coffee to cool down from 75 °C to 50 °C in each cup.



Thickness of coffee cup / mm	Time taken to cool from 75 °C to 50 °C / min
1	18
2	25
3	8
3	16
4	10

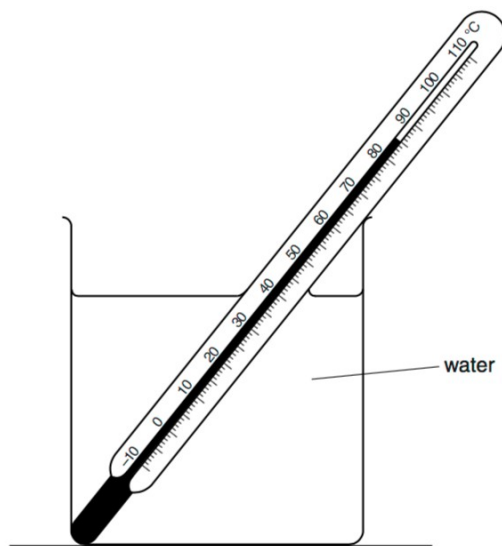
i. **State** and **justify** whether the results of Smith’s investigation support his hypothesis. [1]

ii. **Identify** four weaknesses in Smith’s method. For each of the weaknesses, explain how his investigation was affected. Use scientific knowledge and understanding in your answer. [8]

Q6. The class of MYP 5 students studying unit- Thermal Physics and wants to investigating the cooling of water. The diagram shows some of the apparatus used.

a) A student measures the initial temperature of hot water in a beaker, as indicated by the thermometer in Figure given below. **State** the initial temperature in the first row of Table. [1]

(b) The student allows the water in the beaker to cool and records the temperature at 30s intervals. The readings are shown in the table.



Complete the column headings in the table. [3]

t/	θ /
0	
30	72
60	64
90	60
120	57
150	56

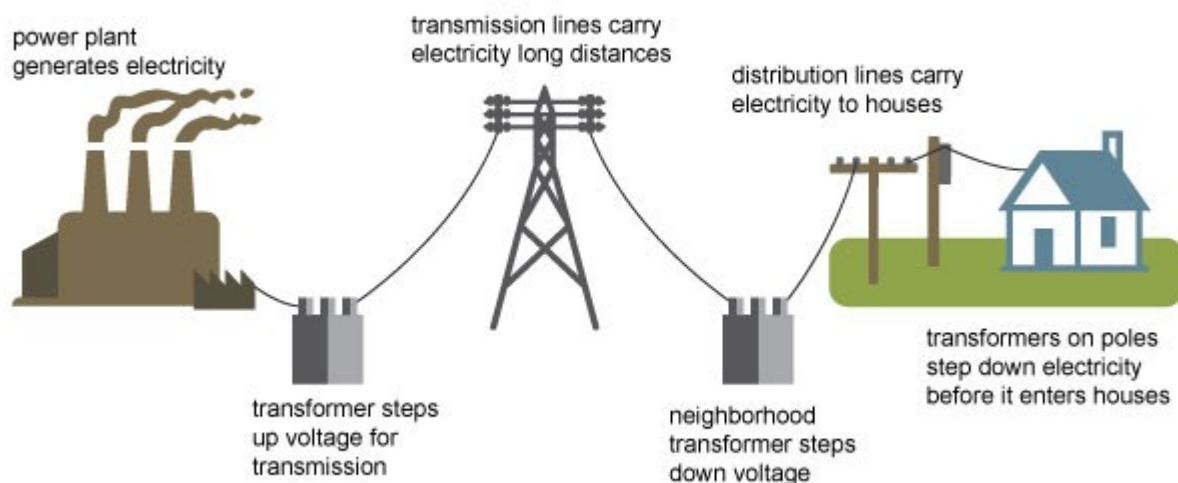
(c) **Draw** a graph of $\theta / ^\circ\text{C}$ (y-axis) against t / s (x-axis). [4]

(d) **State** whether the rate of cooling of the water in the beaker increases, decreases or stays approximately constant during the period of cooling. **Justify** your statement by reference to the graph. [2]

Criterion D: Reflecting on the impacts of sciences

Q7. This question is about generation and transmission of electricity. In many developed countries, electricity is generated in large power stations, far away from where the people who use electricity live and work.

Electricity generation, transmission, and distribution



Source: Adapted from National Energy Education Development Project (public domain)

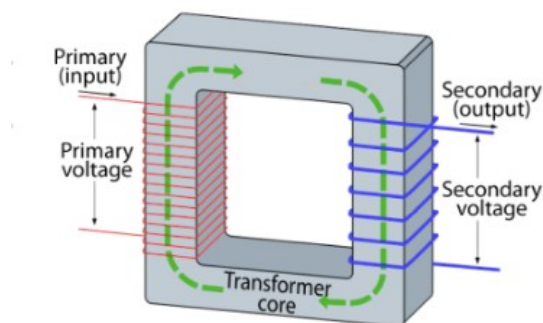
The energy sources that power the generators in large industrial countries are coal, gas and nuclear (fission) reactors, or a mix of these.

i. **Suggest** two reasons why people would not want a coal-fired power station in or near their city. [2]

ii. **Outline** a reason why coal-fired and nuclear power stations are built near large rivers or the sea. [1]

iii. The cables lose some electrical power as it transfers from the power station to the city. One solution is to reduce this power loss by increasing this power loss by increasing the voltage of the electricity in the cables when the energy travels long distance.

A transformer converts current and voltage.



©

For an ideal transformer, the primary (input) power equals the secondary (output) power.

a) If $P = VI$, when the secondary voltage doubles, **state** what happens to the secondary current. [1]

b) **Describe** why increasing the voltage reduces the power lost during transmission. [3]

- c) Coal is a source of energy that is found in many parts of the world. When coal is burned, it produces three gases: water vapor (H_2O), carbon dioxide (CO_2) and sulfur dioxide (SO_2).
Select any two gases listed above and describe a problem associated with each. [4]
- d) Large power stations operate continuously, 24 hours a day, and it often takes many days to turn them on and off. **Suggest** why a power generation company might sell electricity more cheaply at night than during a day. [3]

Q8. Source:

 MARCH 21, 2019

New technology aims to boost wind energy efficiency in Europe

by CORDIS



Credit: pauljrobinson, Shutterstock

Researchers are developing tools to substantially reduce the operations and maintenance costs of wind farms. The novel tools will be tested on three European wind farms in 2020.

The EU has set an ambitious goal to become a world leader in renewable energy. Given that this is a relatively young industry, renewable sources aren't exploited as efficiently as they could be in the future, given time and experience. However, there is progress in the sector. For example, offshore wind energy is becoming more and more competitive and is gaining importance as a part of the power system.

One of the main obstacles in the use of offshore wind energy is the high cost involved in operations and maintenance (O&M). O&M costs make up a big share of the total cost of a wind turbine, often totalling around 30 % of its total life-cycle cost. To boost wind energy in Europe, offshore wind farms need to become more efficient, a problem that the EU-funded project ROMEO is tackling head-on.

ROMEO is developing useful tools that will allow wind farm operators to improve their decision-making processes and shift from corrective, calendar-based to less costly condition-based maintenance strategies. Its advanced monitoring systems will be able to detect key failures in major components of wind turbines. Models are also being developed to diagnose and predict failures in existing turbines, thus minimising downtime. An interoperable cloud-based and Internet of things platform will be providing an advanced analytics system for such diagnosis and prognosis models to better understand how turbine components behave in real time. Operators will therefore be able to maximise the turbines' lifespan and minimise O&M costs.

Pilot tests at German and UK wind farms

The newly developed technology will be tested on three European offshore wind farms next year. The pilot phase test site located in the German waters of the Baltic Sea has a power capacity of 350 MW generated by 70 turbines. The two UK-based facilities are a 27-turbine 62-MW-capacity farm off the North Yorkshire coast and a 108-turbine 714-MW farm off the east coast of East Anglia, both in the North Sea.

"The models and tools that we are developing will be tested ... from mid-2020" reported Cesar Yanes of project coordinator Iberdrola Renovables Energía in a news item published in the 'Offshore Wind Journal'. "The pilot projects will show us how successful we have been and will enable us to test technology that will monitor turbine components such as the gearbox main bearing and transformer and the substructure of a turbine."

Yanes added that by testing their system on different wind farms with dissimilar turbines and environmental conditions, they will be able to prove that their technology can be transferred to other offshore and onshore projects. This, he explained, "will be required if our overall goal of reducing the cost of wind energy is

to be met. Our aim is to reduce the incidence of component failure and unplanned maintenance while increasing reliability."

ROMEO (Reliable OM decision tools and strategies for high LCoE reduction on Offshore wind) is harnessing the wide-ranging expertise of its 12 project partners, including turbine component manufacturers, service providers, wind farm operators and IT market leaders. The pilot phase of ROMEO is expected to last until the end of the project in 2022.

Discuss and evaluate

[15]

- i. Advantages and disadvantages of wind farms.
- ii. Environmental and Economic impacts.
- iii. Concluding appraisal