ALEXANDER ROAD HIGH SCHOOL

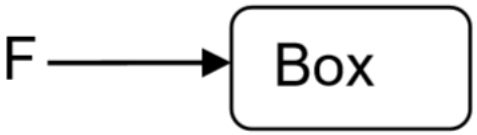
FEBRUARY 2020 50 MIN

PHYSICAL SCIENCES CONTROL TEST

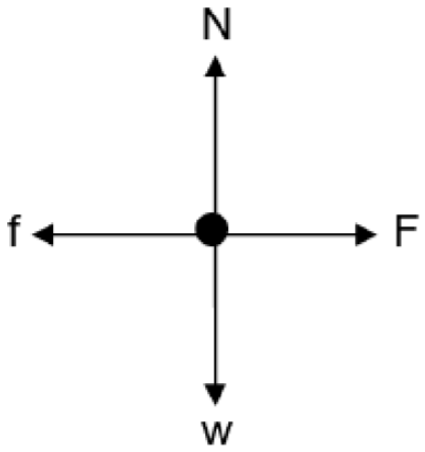
EXAMINER: CO **GRADE 12** TOTAL = 45

1. Write down the letter of the correct answer next to the question number.

1.1 A CONSTANT FORCE F is applied to a box, causing the box to move at a CONSTANT VELOCITY over a rough horizontal surface.



The free-body diagram below shows all forces acting on the box. THE DIAGRAM IS NOT DRAWN TO SCALE.



Which ONE of the following relationships is correct?

A F < f

B F > f

C F = w

D F = f

1.2 An astronaut has a weight of W on earth. He lands on a planet with mass three times greater than the earth and a radius twice that of the earth. What is the weight of the astronaut on this planet? Take the radius of the earth as R.

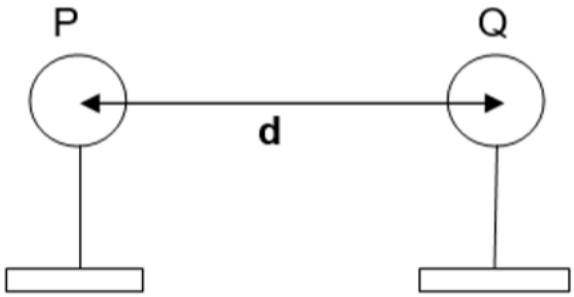
A $\frac{3}{16}$ W

B $\frac{3}{4}$ W

C $\frac{3}{2}$ W

D 3 W

1.3 Two small, identical positively charged spheres P and Q on insulated stands are placed a distance **d** apart as shown below. The magnitude of the force exerted by Q on P is **F**.



If the distance is now changed to ½ **d**, the new force between the spheres is …

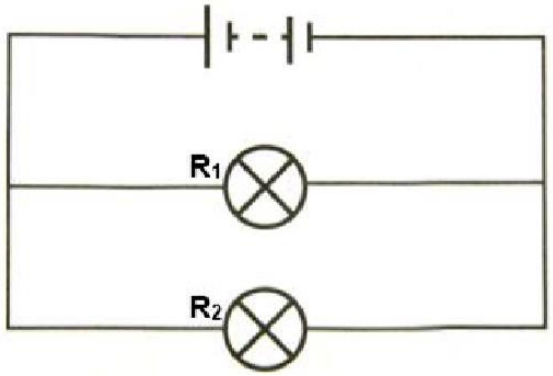
A ¼ **F**

B ½ **F**

C 2 **F**

D 4 **F**

1.4 Two light bulbs are connected across a battery of emf ε and negligible internal resistance as shown in the diagram below.



The battery delivers maximum voltage. If the power of R_1 is greater than the power of R_2, which statement is CORRECT?

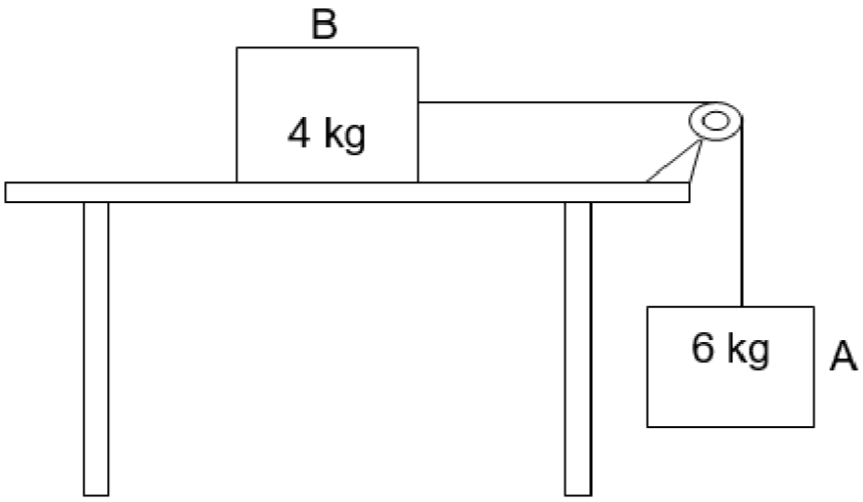
A The resistance of R_1 is greater than the resistance of R_2.

B The resistance of R_2 is greater than the resistance of R_1.

C The resistance of R_1 is equal to the resistance of R2.

D The resistance of R_1 is equal to 0 Ω. **[4 x 2 = 8]**

2. A 4 kg block B, resting on a flat, rough horizontal table, is connected by a light inextensible string to a 6 kg block A. The string is passed over a light frictionless pulley in such a way that block A hangs vertically downwards as shown in the diagram below.



2.1 Write down Newton's Second Law of motion in words. (2)

2.2 The kinetic frictional force experienced by block B is 32,53 N to the left. Calculate the magnitude of the acceleration. (6)

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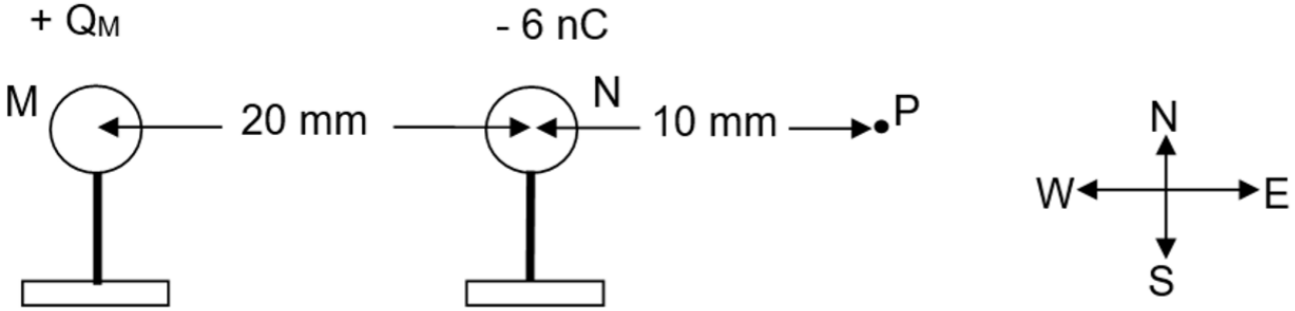
3. Two metal spheres, M and N, on insulated stands carry charges $+Q_M$ and -6 nC respectively. The distance between the two charges is 20 mm and P is a point at 10 mm from sphere N as shown below. The NET ELECTRIC FIELD at point P due to the presence of M and N is $5,2 \times 10^5$ N·C^{-1} westwards.



3.1 Define the term ELECTRIC FIELD at a point. (2)

3.2 Calculate the magnitude of charge Q_M on sphere M. (6)

3.3 Draw an electric field pattern for sphere N **only** (with no influence from sphere M). (2)

3.4 If the two spheres were allowed to make contact and then moved back to their original positions, will an electron transfer take place and in which direction will the transfer be, or will there be no transfer?

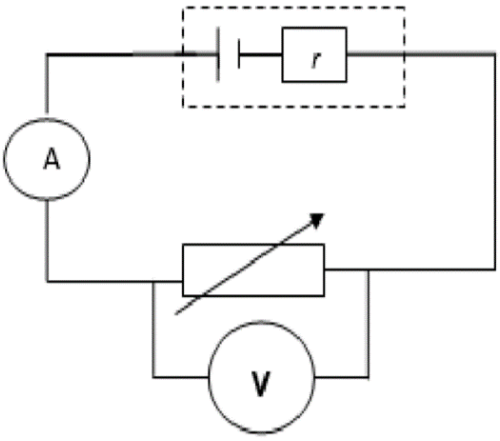
Choose one of the following letters (only write A, B, or C): **A** – no electron transfer,

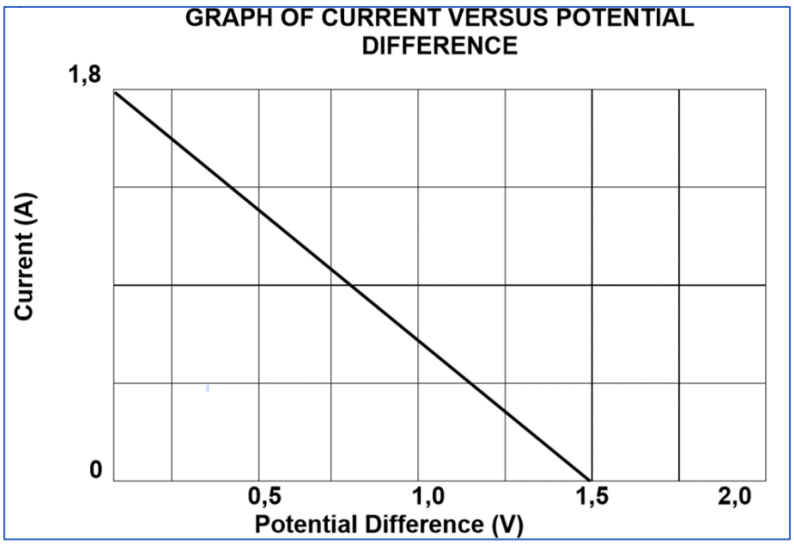
B – transfer from N to M or

C – transfer from M to N. (2)

[12]

4. Learners conduct a circuit experiment as shown in the diagram below, and the results obtained are shown in the graph.

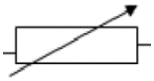




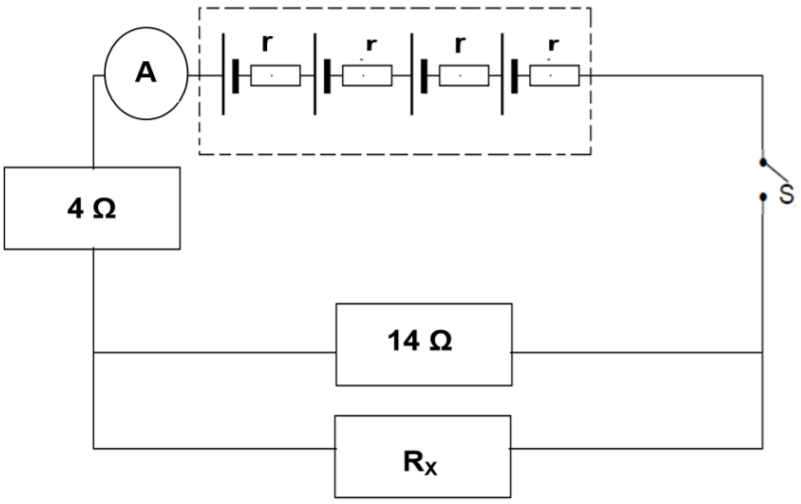
4.1 **Use the graph** to determine the following:

4.1.1 Emf (ε) of the battery (no calculation needed) (1)

4.1.2 Internal resistance of the battery, **WITHOUT** USING THE EQUATION ε = I(R + r) IN YOUR CALCULATIONS. (4)

4.2 Give the name of the component that the circuit symbol  represents? (1)

4.3 Four identical cells, **EACH** with an emf of 1,5 V and an internal resistance of 0,25 Ω are connected in series with each other. The battery is connected to the resistors as shown below.



4.3.1 Write down the potential difference across the cells when the switch is open. (2)

4.3.2 When switch S is closed, the potential difference across the 4 Ω resistor is 2 V.

Calculate the:

(a) Current in the circuit (2)

(b) R_X (7)

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/45/