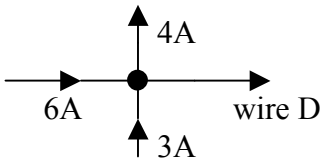
MODULE PHY2 REVISION

1. (a) What is the unit of charge expressed only using base S.I. units?
(b) Calculate the current flowing if a charge of 300mC passes a point in one minute.
(c) The diagram opposite shows the junction of four conductors.
How much charge must be moving out along wire D in 30seconds?



2. Why must an ammeter be placed in series with circuit components?
3. (a) What is meant by 'drift velocity'?
(b) Calculate the drift velocity of the free-electrons along a piece of copper wire of diameter 1mm and charge-carrier density 2.0×10^{29} m^{-3} when it is carrying a current of 3A.
4. In terms of the movement and density of charge carriers explain why the resistance of metals increases with temperature but that of semiconductors decreases.
5. Define: (a) electrical potential difference; (b) electromotive force.
6. Calculate the power supplied by a cell of emf 6V when supplying a current of 500mA.
7. How much work is done by a 230V power supply when driving a current of 2A through a device for 5 minutes?
8. Why must a voltmeter be placed in parallel with circuit components?
9. (a) Draw a circuit diagram showing how you could measure how the current through a device varies with the potential difference applied across it.
(b) Sketch the graphs you would expect to obtain for: (i) a piece of resistance wire kept at a constant temperature; (ii) a light bulb; (iii) a diode. In all three cases your graphs should show four quadrants.
10. (a) State Ohm's law. (b) Which of the devices in question 9(b) obey Ohm's law?
11. Define: (a) resistance; (b) resistivity.
12. What is the unit of resistance in base S.I. units?
13. Calculate: (a) the potential difference required to drive a current of 60mA through a resistance of 2kΩ?
(b) the resistance of a conductor if a p.d. of 12V causes a current flow of 500μA;
(c) the current flow when a p.d. of 2kV is applied to a resistance of 6MΩ.
14. Calculate the resistance of a length of metal wire of radius 0.60mm; length 50cm and resistivity 4.5×10^{-6} Ωm.
15. If the current through a resistance is doubled what change occurs to the rate in which it converts electrical energy to heat?
16. A power supply of 230V is connected to a light bulb of power 60W. What should be the resistance of the bulb and the current flowing through the bulb?
17. (a) What is meant by 'internal resistance'?
(b) Why will a 12V battery made up of dry cells not be able to start a car?
18. Describe how you might go about measuring the internal resistance of a battery.
19. A battery of emf 6V is connected to a resistance 10Ω. A current of 0.50A flows through the resistor.
Calculate or state: (a) the potential difference across the resistor; (b) the terminal potential difference of the battery; (c) the internal resistance of the battery.
20. Show that the total resistance, R of three resistors, R1, R2 & R3 connected in parallel
is given by the equation: 1/R = 1/R1 + 1/R2 + 1/R3.
21. You are supplied with three resistors each of value 30Ω. Draw diagrams showing hoe you could connect two or three of these resistors together in order to make a total resistance of: (a) 15Ω; (b) 45Ω; (c) 20Ω.
22. Describe how you would use an ohmmeter to measure the resistance of a resistor.
23. Sketch a graph showing how the current flowing through a thermistor would vary with temperature.
24. Draw the circuit symbol for an LDR and state under what conditions its resistance is high.
25. (a) Draw a circuit diagram of a potential divider that contains a thermistor and a 200Ω resistor connected to a 12V power supply.
(b) At 20°C the thermistor has a potential difference of 3V, (i) what is its resistance? (ii) What current is flowing through the 200Ω resistor?
(c) If the temperature of the thermistor is raised, how will the
answers in part (b) change? (no calculations needed here)
26. (a) Define 'specific heat capacity'. (b) Express the unit of SHC in S.I. base units.
27. (a) Describe how you would measure the specific heat capacity of a liquid using an electrical heater.
(b) Suggest some sources of experimental error and the likely affect they would have on your final calculation.
28. Calculate the specific heat capacity of a metal block of mass 400g if when supplied by heat from an electrical heater of power 50W for 10 minutes its temperature rises from –20°C to + 30°C.

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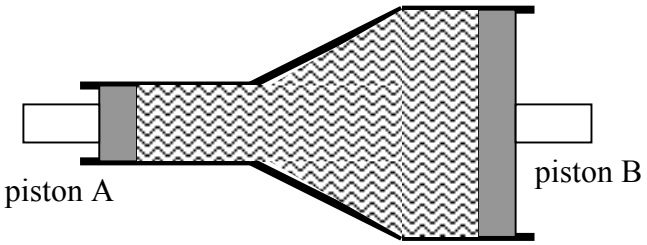
29. What changes occur to the molecules of a substance when it changes from:
(a) a solid to a liquid; (b) a gas to a solid.
30. Define 'specific latent heat'.
31. Describe how you would measure the specific latent heat of ice.
32. (a) Calculate the total time taken for a kettle of power 2kW to raise the temperature of 500g of water from 20^{o}C to 100oC and to boil away 200g of the water. [SHC water = 4200J/(kgK); SLH(steam) = 2.3MJ/kg].
(b) What have you assumed in part (a)?
33. Calculate the pressure (in pascals) exerted on the ground by a person of mass 70kg if their feet have a total contact area with the ground of 350cm^{3}.
34. (a) The diagram opposite shows a pipe containing a liquid with pistons at either end. If a force of 500N is exerted on piston A which has a cross-section area of 600mm^{3} calculate the area of piston B if it experiences a force of 1500N.
(b) If the liquid was replaced by a movable solid what would the force be at piston B now?



35. (a) Explain how a gas can exert a pressure.
(b) Explain why the pressure of a gas increases if its volume is decreased at constant temperature.
(c) Explain why the pressure of a gas increases if its temperature is decreased at constant volume.
36. (a) Describe an experiment to show that for a gas at constant volume, p/T = constant.
(b) How can the temperature of absolute zero be predicted from the measurements made in this experiment?
37. (a) Convert to ^{o}C temperatures: (i) zero kelvin; (ii) 273K; (iii) 6000K
(b) Convert to kelvin temperatures: (i) – 273^{o}C; (ii) – 100^{o}C; (iii) 100^{o}C
38. A gas at constant volume has a pressure of 100kPa at 27^{o}C.
What would you expect its pressure to be at 627^{o}C?
39. (a) Describe an experiment to show that for a gas at constant T: pV = constant.
(b) The following results were obtained from such an experiment. Use them to draw an appropriate graph to back up the equation.

Volume (cm^{3})	20.0	18.0	16.0	15.0	14.5	14.0	13.7
Pressure (kPa)	100	110	127	133	138	143	146

40. For ideal gases: pV = nRT.
(a) Define the meaning of the terms in this equation.
(b) Use this equation to calculate the approximate number of air molecules in the room you are sitting in now.
(c) What is an ideal gas?
41. (a) Explain how Brownian motion supports the kinetic theory of gases.
(b) How can Brownian motion be demonstrated?
42. (a) What assumptions are required of a gas in order to use the equation: $p = {}^{1}/_{3}\ \rho <c^{2}>$.
(b) Use this equation to calculate the root-mean-square-speed of the gas molecules in this room.
43. What property of gas molecules is proportional to its kelvin temperature?
44. (a) What is meant by 'internal energy'. (b) How is internal different in hot and cold objects?
45. State the first law of thermodynamics.
46. An electric current of 2A supplied by a 12V power supply maintains a light bulb at a constant temperature.
What, in this situation, are the values of: (a) work being done by the power supply;
(b) internal energy change of the bulb filament;
(c) heat energy change of the bulb filament?
47. What is (a) a 'heat engine'?; (b) a cold sink?
48. Calculate the maximum thermal efficiency of a heat energy that uses gases that have a combustion temperature of 700^{o}C and an exhaust gas temperature of 100^{o}C.
49. (a) What is a heat pump? (b) Give an example of a heat pump.