A-Level Physics Transition Activities

Congratulations for choosing one of the most challenging and rewarding courses of study at A-Level! In September, you will be working towards a qualification in science that is both worthwhile in itself and highly respected by employers and universities.

The secret to learning physics is to spend lots of time solving problems and answering questions. While you might have been able to get by in your GCSE's by reading though your notes and revision guides and just letting the information soak into your brain, for A-Level you'll have to adopt a much more active learning style. *Real* learning happens when you spend time reasoning through questions and working stuff out for yourself. There really is a big difference between the strategy that probably got you by in school and the work you will need to do for your A-Levels

The tasks below give you the opportunity practice some of the basic skills that you'll need to be successful on the course. You'll need to have worked though these tasks before September. At the end of these tasks there's a list of (optional) books and websites that you might find useful for developing your general appreciation of physics. If you're already thinking about studying physics or maths at university then these will equip you with lots of ammunition for your UCAS personal statement and university interviews. In both of these you'll want to talk about some of the big ideas in physics that have captured your imagination.

Best wishes

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Task 1 - Head Start to AS Physics

Work through 'Head Start to AS Physics'. ISBN: 978 1 84762 115 3

Available from Amazon guite cheaply.

Task 2 - The Following summary questions are taken from the course text book

They cover Standard Form, trigonometry, rearrangements and converting units. These are key skills in physics, and being proficient in them will mean that you can focus on

understanding the other topics





Summary questions 🤕

Write your answers to each of the following questions in standard form, where appropriate, and to the same number of significant figures as the data.

- 1 Copy and complete the following conversions.
 - **a i** 500 mm = ____ m
 - ii 3.2 m = ____ cm
 - iii 9560 cm = ____ m.
 - **b** i 0.45 kg = _____ g
 - ii 1997 g = _____ kg
 - iii 54 000 kg = _____ g.
 - **c i** $20 \text{ cm}^2 = _ \text{m}^2$
 - ii $55 \,\mathrm{mm^2} = ___\,\mathrm{m^2}$
 - iii $0.050 \text{ cm}^2 = _ \text{m}^2.$
- 2 a Write the following values in standard form:
 - i 150 million km in metres
 - ii 365 days in seconds
 - iii 630 nm in metres
 - iv 25.7 µg in kilograms
 - v 150 m in millimetres
 - vi 1.245 µm in metres.
 - **b** Write the following values with a prefix instead of in standard form.
 - i $3.5 \times 10^4 \, m = _$ km
 - ii $6.5 \times 10^{-7} \,\mathrm{m} = _$ nm
 - iii $3.4 \times 10^6 \text{ g} = _$ kg
 - iv $8.7 \times 10^8 \text{ W} = _$ MW = ____ GW.

- 3 a Use the equation average speed = distance/time to calculate the average speed in m s⁻¹ of:
 - i a vehicle that travels a distance of 9000 m in 450 s
 - ii a vehicle that travels a distance of 144 km in 2 h
 - iii a particle that travels a distance of 0.30 nm in a time of 2.0 \times $10^{-18}\,s$
 - iv the Earth on its orbit of radius 1.5×10^{11} m, given the time taken per orbit is 365.25 days.
 - b Use the equation resistance = potential difference

current

to calculate the resistance of a component for the following values of current *I* and pd *V*:

- i V = 15 V, I = 2.5 mA
- ii V = 80 mV, I = 16 mA
- iii V = 5.2 kV, I = 3.0 mA
- iv V = 250 V, I = 0.51 µA
- **v** V = 160 mV, I = 53 mA.
- 4 a Calculate each of the following:

i	6.7 ³	iv	(0.035) ²
ii	(5.3 × 10 ⁴) ²	v	$(4.2 \times 10^8)^{1/2}$

- iii $(2.1 \times 10^{-6})^4$ vi $(3.8 \times 10^{-5})^{1/4}$.
- b Calculate each of the following:

i	2.4 ²		$\frac{8.1\times10^4+6.5\times10^3}{5.3\times10^4}$		
	3.5×10^3				
ii	$\frac{3.6\times 10^{-3}}{6.2\times 10^2}$	iv	$7.2 \times 10^{-3} + \frac{6.2 \times 10^4}{2.6 \times 10^6}$		

Summary questions 🤕

- Calculate the circumference of a circle of radius 0.250 m.
 - Calculate the length of the arc of a circle of radius
 0.250 m for the following angles between the arc and the centre of the circle:
 - i 360° ii 240° iii 60°.
- 2 For the right-angled triangle XYZ in Figure 6, calculate:
 - a angle YXZ (= θ) if XY = 80 mm and
 - i XZ = 30 mm
 - ii XZ = 60 mm iii YZ = 30 mm
- x θ z
- **iv** YZ = 70 mm
- x Figure 6
- **b** XZ if
 - i XY = 20 cm and θ = 30°
 - ii XY = 22 m and θ = 45°
 - iii YZ = 18 mm and θ = 75°
 - iv YZ = 47 cm and θ = 25°.

Summary questions 🤕

- 1 Complete each of the following statements:
 - **a** if x > 5, then 1/x <
 - **b** if 4 < x < 10, then _____ < 1/x <
 - c if x is positive and $x^2 > 100$ then 1/x _____.
- 2 a Make t the subject of each of the following equations:
 - i v = u + at iii $y = k(t t_0)$
 - ii $s = \frac{1}{2}\alpha t^2$ iv $F = \frac{mv}{t}$.
 - **b** Solve each of the following equations:
 - i 2z + 6 = 10 iii $\frac{2}{z-4} = 8$
 - ii 2(z+6) = 10 iv $\frac{4}{z^2} = 36$.
- **3 a** Make *x* the subject of each of the following equations:
 - i $y = 2x^{1/2}$ iii $yx^{1/3} = 1$
 - ii $2y = x^{-1/2}$ iv $y = \frac{k}{x^2}$.

- A right-angled triangle XYZ has a hypoteneuse
 XY of length 55 mm and side XZ of length 25 mm.
 Calculate the length of the other side.
 - b An aircraft travels a distance of 30 km due north from an airport P to an airport Q. It then travels due east for a distance of 18 km to an airport R. Calculate
 - i the distance from P to R
 - ii the angle QPR.
- Calculate the horizontal component A and the vertical component B of:
 - i a 6.0 N force at 40° to the vertical
 - ii a 10.0 N force at 20° to the vertical
 - iii a 7.5 N force at 50° to the horizontal.
 - Calculate the magnitude and direction of the resultant of a 2.0 N force acting due north and a 3.5 N force acting due east.
 - **b** Solve each of the following equations:
 - i $x^{-1/2} = 2$ ii $3x^2 = 24$ iv $2(x^{1/2} + 4) = 12$.
- 4 Use the data given with each equation below to calculate:
 - **a** the volume V of a wire of radius r = 0.34 mm and length L = 0.840 m, using the equation $V = \pi r^2 L$
 - **b** the radius *r* of a sphere of volume $V = 1.00 \times 10^{-6} \text{ m}^3$, using the equation $V = \frac{4}{3}\pi r^3$
 - **c** the time period *T* of a simple pendulum of length L = 1.50 m, using the equation $T = 2\pi (L/g)^{0.5}$, where g = 9.8 m s⁻²
 - **d** the speed v of an object of mass m = 0.20 kg and kinetic energy $E_k = 28$ J, using the equation $E_k = \frac{1}{2}mv^2$.

Task 3 - Reading up on some A-Level work

The textbook for the physics course is available on $Amazon^1$ for about £35. You might be able to find it cheaper second hand somewhere. Other books are available, but this is the one that we'll be using in class.

In September we'll be starting with particle physics. You'll find things much easier if you have gained some familiarity with some of the important new words before we get started. Particle physics will require us to use many words that are not familiar, so the more practice we get the better! You can

use the text book, the internet or whatever source of information you choose to answer the following questions.

1. Write a sentence describing what is meant by the term fundamental particle...

E: complete the following fable(3)					
Sub atomic particle	Mass in kg	Charge in Coulombs	Location		

2. Complete the following table(s)

- 3. There are two families of fundamental particle. Write down their names...
- 4. Particles such as protons and neutrons are made up of even smaller particles. Write down the names of each of the three particles that are inside a proton.
- 5. Write down the names of the three particles that make up a neutron.

Task 4 – Specific Charge

Background

The specific charge of a charged object is its charge divided by its mass. As the unit of charge is the coulomb (C) and the unit of mass is the kilogram (kg), the unit of specific charge is the coulomb per kilogram (C kg-1).

Every atom contains a positively charged nucleus surrounded by electrons, which are negatively charged. Every nucleus contains protons and neutrons, except the hydrogen-1 nucleus, which is a single proton. Neutrons and protons in a nucleus are called nucleons.



Questions

- 1) Calculate the specific charge of the 3 subatomic particles
- 2) Complete the following table (note ignore the electrons as we are concerned with the nucleus)

Nucleus	No of nucleons (mass number)	Overall mass in kg (mass number x 1.67 x 10 ⁻²⁷ kg)	Number of Protons (proton number)	Overall Charge (no of protons x 1.60 x 10 ⁻¹⁹ C)	Specific Charge = (charge / mass)
⁵² 24Cr					
¹² ₆ C					
⁵⁶ ₂₆ Fe					
⁷ ₃ Li					

Further Reading

Read any, all or none of these. It's up to you! You won't be disadvantaged by not reading these, but if you think you might want to go on to study physics or maths at university then picking up at least one of these at some point would be a good idea. Hawking's book is probably the most accessible one on the list so you might want to start there. Most of these can be picked up quite cheaply second hand.

Hawking, S. (1998) A Brief History of Time, ISBN: 0553380168 - This is a very good general physics book. The early chapters provide a neat account of our how our understanding of the universe has evolved over history.

Allday, J. (2001) Quarks, Leptons and the Big Bang, ISBN: 0750308060 - This book contains lots of modern physics and should provide you with plenty to think about.

Feynman, R. (1994) The Character of Physical Law, ISBN 0679601279 - The opening chapters provide a good account of why physics is mathematical. Interesting stuff.

Joining the Institute of Physics as a 16-19 student is free. You'll get a free electronic copy of *Physics World* magazine each month. You can join by going to:

http://members.iop.org/16-19.asp

Objectives

The concepts of kinematics

Student's will be able

- Define the concepts of displacement, velocity and acceleration,
- Calculate changes in displacement or velocity without math or graphs.

Problems:

- 1. A runner is moving with a velocity of 4 m/s when they accelerate at 2 m/s for 3 seconds. How fast are they traveling now?
- 2. In a football game, running back is at the 10 yard line and running up the field towards the 50 yard line, (10, 20, 30, 40 yard line etc.) and runs for 3 seconds at 8 m/s. What is his current position?
- 3. A cat is moving at 18 m/s when it accelerates at 4 m/s for 2 seconds. What is his new velocity?
- 4. A race car is traveling at 76 m/s when is slows down at 9 m/s for 4 seconds. What is his new velocity?
- 5. An alien spaceship is 500 m above the ground and moving at a constant velocity of 150 m/s upwards. How high above the round is the ship after 5 seconds?
- 6. A bicyclist is traveling at 25 m/s when he begins to decelerate at 4 m/s. How fast is he traveling after 5 seconds?
- 7. A squirrel is 5 ft away from your while moving at a constant velocity of 3 ft/s away from you. How far away is the squirrel after 5 seconds?
- 8. A ball is dropped off a very tall canyon ledge. Gravity accelerates the ball at 22 mph/s. How fast is the ball traveling after 5 seconds?
- 9. During a race, a dragster is 200 m from the starting line and something goes wrong and is stops accelerating. It travels at a constant velocity of 100 m/s for 3 seconds to try to finish the race. How far from the starting line of the dragster after 3 seconds?
- 10. A dog is 60 yards away while moving at a constant velocity of 10 yds/s towards you. Where is the dog after 4 seconds?

The Math of Kinematics

Solve for the letter in each equation.

17)
$$-3 = -2 + 8(t) + \frac{1}{2}(6)t^2$$
25) $v^2 = 2^2 + 2(-3)(-2)$ 18) $x = -2 + 5(3) - \frac{1}{2}(3)5^2$ 26) $4^2 = v_0^2 + 2(-3)2$ 19) $1 = x_0 - 5(3) - \frac{1}{2}(8)2^2$ 27) $1^2 = 5^2 + 2a(-2)$ 20) $-3 = 2 + 8(4) + \frac{1}{2}(g)4^2$ 28) $(-2)^2 = (-5)^2 + 2(6)x$ 21) $3^2 = 4^2 + 2a10$ 29) $8^2 = v_0^2 + 2(5)2$ 22) $v^2 = 8^2 + 2(3)(-6)$ 30) $2 = (-4)^2 + 2(-4)x$ 23) $(-3)^2 = v_0^2 + 2(-2)4$ 31) $5^2 = 2^2 + 2a3$ 24) $8 = 4^2 + 2(3)x$ 32) $v^2 = 8^2 + 2(5)(-2)$

The Math of Kinematics

Solve for the letter in each equation.

$$33) \frac{3}{t} = \frac{3+4}{2} \qquad 40) \frac{6}{t} = \frac{4+3}{2} \qquad 47) \frac{x}{4} = \frac{3+6}{6}$$

$$34) \frac{x}{2} = \frac{5+2}{2} \qquad 41) \frac{1}{3} = \frac{6+2}{d} \qquad 48) 5 = \frac{6+1}{w}$$

$$35) \frac{3}{5} = \frac{v+6}{2} \qquad 42) \frac{1}{t} = \frac{5+2}{2} \qquad 49) \frac{8}{3} = \frac{v+4}{3}$$

$$36) 5 = \frac{3+v_0}{2} \qquad 43) \frac{x}{3} = \frac{5+6}{4} \qquad 50) 4 = \frac{5+v_0}{8}$$

$$37) \frac{x}{3} = \frac{2+6}{2} \qquad 44) \frac{7}{2} = \frac{v+3}{3} \qquad 51) \frac{1}{t} = \frac{2+4}{3}$$

$$38) \frac{7}{2} = \frac{v+2}{2} \qquad 45) \frac{4}{7} = \frac{2+v_0}{5} \qquad 52) 2 = \frac{4+2}{y}$$

$$39) \frac{3}{6} = \frac{8+v_0}{2} \qquad 46) \frac{6}{t} = \frac{2+6}{8} \qquad 53) \frac{2}{7} = \frac{v+2}{7}$$

Another fine Resource by T. Wayne (2019 Edition)

Projectile Motion Problems

Please do all of your work on a separate piece of paper.

For each of these vectors write an expression for the horizontal and vertical components. Use the only angles that are given.



Electricity Basics

Current Definition

- 1. 3.00 C of charge pass a point in a wire in 3.0 ms. how much current is this?
- 2. 3.00 X 10¹² electrons pass a point in a wire in 0.0060 seconds. What is the current in the wire in amps?
- **3.** How many electrons pass a point in a conductor in 1 second if the wire's current is 0.05 amps?

Ohm's Law

- **4.** The fuse for a car radio is a thin wire. The wire is made to burn apart is the current is too high. What is the resistance of a fuse if it is to burn apart when 2.00 amps pass though it at 240 volts?
- 5. A light bulb is plugged into a wall outlet. It uses 0.68 A. What is the light bulb's resistance?
- **6.** A flash light bulb is labeled to uses 1.77 A. Its resistance is 1.60 Ω . What voltage is the light bulb rated for?
- **7** A 1.5 volt battery is has a wire connecting its positive side to its negative side. The battery draws 0.10 amps of current. What is the resistance in the battery to create this current?



- **8** A flashlight light bulb is rated to take 2.83 Volts and use 0.300 amps. What is the resistance of the filament?
- **9** Another flash light bulb is rated to use 0.300 A and has a resistance of 4.0 Ω . How much voltage does this bulb use?
- **10** A stereo speaker has a resistance of 8.00 Ω . When it is operating at full power (exactly100 watts) it uses 35 volts of electricity. What is the current drawn by the speaker?
- **11** A 100 Watt light bulb draws 0.83333 amps from a wall outlet (120 volts). What is the resistance of the light bulb's filament?
- **12** A toaster plugged into the wall, (120 volts), uses 14 amps of electricity. What is the resistance of the toaster?
- **13** The thermostat in a house turns on and off the air conditioner and furnace using 24 volts. What is the resistance in the thermostat when it is turned on it if draws 0.100 amps?

Electricity Basics

- 14 A motor in a radio control car uses 7.2 volts and draws 14.4 amps of electricity. What is the resistance of the motor?
- **15** The volume knob on a radio varies the resistance on a line that goes to the speakers. At a low volume the resistance is 10,000 Ω . At a high volume the resistance is 10 Ω . If the stereo maintains 35 volts into the speaker then, what are the two currents going into the speaker?
- **16** When a battery "dies" the resistance inside the battery rises while the voltage it can produce almost always remains the same. A new 1.5 volt alkaline battery has a resistance of 0.15 ohms. An older battery may have a resistance of 15 Ω . how much current is drawn by a new and old battery?
- **17** The resistance of dry human skin is about 500,000 Ω and wet, sweaty, human skin is about 1000 Ω . How much current passes across someone's fingers if they touch the leads of a 9 Volt battery when their skin is wet or dry?
- **18** 0.010 A causes involuntary muscle contractions. How much voltage is required to cause involuntary muscle contractions on wet and dry skin?

Power

- **19** A watch battery produces a voltage of 1.5 volts. How much power is used by the watch if it draws 0.001 A?
- **20** A high-tension power line carries 1,000,000 volts of electricity. If the line is to carry 200 A's, then how much power does the power line carry? What is the resistance of the power line?
- **21** A battery is rated at 1.5 volts. This battery can produce a maximum of 15 W of power.
 - How much current can this battery produce?
 - What is the resistance of the wire attached to the battery?
- **22** A stereo speaker is rated at 8 ohms and 40 Watts. A fuse is going to be installed in the speaker. How much current does the fuse need to handle if it is to "blow" at 40 watts?
- 23 A radio control car uses 7.2 volts and 14 amps. How much power does the car use?
- 24 What are the resistances of a 50, 100 and 150 Watt light bulb that is plugged into a wall outlet, 120 volts?
- **25** A shorted out 12 V car battery can generate 4800 amps! (Never do this. a shorted out battery <u>will</u> explode.) What is the battery's resistance and how much power is generated by the battery before it explodes?

Electricity Basics

- **26** A hair dyer says it generates 1400 Watts. It is plugged into a wall outlet, 120 volts. What is the current drawn by the hair dryer and what is its resistance?
- 27 On most home each circuit in a house can handle 15 amps at 120 volts. How much power is this? Will a 1400 Watt hair dryer and four 75 Watt light bulbs blow this circuit?
- **28** The heating element on a stove is connected to a 240 V outlet. The element draws 20 amps when it is turned on. What is the resistance and power of the element?
- **29** A motor on a band saw can generate 1/2 horsepower on high. If the motor is plugged into a wall outlet, how much current will it require? (746 W = hp)
- **30** The garbage disposal in a sink can generate 3/4 horsepower. If the disposal is plugged into a wall outlet, then how much current does it draw?
- **31** A small car can generate 95 hp. An equivalent electric vehicle is to be built such that it can generate the same power as its gasoline counter part. If the electric vehicle's motor uses 12 volts, then what is the resistance of the motor? What is the current drawn by the motor? How many charges are moved by the current if the car runs for 1 hour?
- **32** What is the current drawn by a household clock radio using 12 watts?
- **33** A fan draws 0.184 amps while connected to a wall outlet. What is the power rating of this fan?
- **34** What is the current drawn by a hair dryer using 1500 watts?
- **35.** What is the current drawn by car stereo that is connected to the car's 12.0 volt battery, if the car stereo draws 40 watts?
- **36.** What is the battery voltage of a portable radio that draws 0.500 amps and is rated at 1.5 watts?
- **37** You've just invented a "Do-Hickie" that uses 3.0 volts and draws 3.0 amps. What is the power rating of your "Do-Hickie?"
- **38** What is the power rating of a household light bulb that draws 0.60 amps?
- **39** How much current would it take to burn apart the wire inside of a 5 Amp fuse if it were connected to a 120 Volt or a 12 Volt source?
- **40** Stereo speaker is rated to take 100 watts. If the speaker's resistance is 8 Ω , how much voltage does the speaker use?

The Nature of the Electromagnetic Spectrum (Light)





Another fine resource by T. Wayne (2019 Edition)

The Nature of the Electromagnetic Spectrum (Light)



Another fine resource by T. Wayne (2019 Edition)

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Scientific Notation

Express each number in scientific notation.

	Number Answer		Number
1.	2300	28.	23.5 X 10 ²
2.	0.250	29.	0.0235 X 10 ⁻² .
3.	100	30	56 X 10 ⁷
4.	15	00.	4
5.	36.258	31.	200 X 10'
6.	0.000025	32.	456.3 X 10 ^{–5}
7.	1.0002	33	9 605 X 10 ⁴
8.	14.00125		7
9.	15.000	34.	200 X 10 ⁻⁷
10.	200,000	35.	20.56 X 10 ²
11.	123,505	36	2359 X 10 ⁵
12.	1,125,215.360		
13.	125.00	37.	7000 X 10°
14.	12.00125	38.	535.0 X 10 ¹
15.	25,802,682	39.	0.0036 X 10 ^{-3}
16.	0.002	40.	23.08 X 10 ⁵
17.	10		
18.	55.02	41.	9.00001 X 10 ⁻²
19.	123.0	42.	0.00825 X 10 ²
20.	12.000	43.	0.000524 X 10 ⁻¹
21.	123.0225		a aaaa x 4a - 6
23.	125,004	44.	0.0988 X 10 °
24.	0.0000025	45.	2365.80 X 10 ²
25.	0.2000025	46.	0.0050 X 10 ⁹
26.	0.00002654	47	9 X 10 ⁴
27.	12,358.023150	77.	o / (o
		48.	585 X 10 ²

Answer

Isolating a variable (math skill)

Isolate the first variable in the expression

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Example x : y = zx + wAnswer: x = y - wz

- 1. u : t = u + st
- 2. $d: d = c + df + 2hf^2$
- 3. $k: m = k^2 + 4jn$
- 4. $v: e = r + te + \frac{1}{2}ve^{2}$

5.
$$f: 5y = f + ke$$

- 6. $m: s = x + 2sm^2$
- 7. $z: i = h + kn + \frac{1}{2}zr^2$
- 8. c : 2d = 4j + 2c
- 9. $p: w_2 = p_2 4ag$
- 10. $h: d = at sy \frac{1}{2}gh^2$

Introduction to using math prefixes.

Objectives 🗆

Students will be able to:

- Write the power of ten associated with the prefixes, "G, n, M, μ, k, m and c," from memory.
- Write the "math" word that describes "G, n, M, μ, k, m and c." from memory.
- Convert to and from any unit with an, "G, n, M, μ, k, m and c" as a unit prefix without a conversion chart.
 - Examples include but are not limited to:
 - Grams to kilograms
 - Meters to kilometers
 - Meters to centimeters

Problems

- 1. 35 g to kg
- 2. 6.0 cm to m
- 3. 500 cm to m
- 4. 10kmi to mi
- 5. \$6M to \$
- 6. 2400 Gm to m
- 7. 45 µs to s
- 8. 15 mNs to Ns
- 9. 4320 cRad to Rad
- 10. 35 mft to ft
- 11. 15 m to cm
- 12. 14 lb to mlb
- 13. 13 cs to s
- 14. 0.001 s to ms
- 15. 1000 T to MT
- 16. 1500 A to kA
- 17. 390s to µs
- 18. 54 H to cH
- 19. 0.0400 V to μV
- 20. 355,944 lumens to Glumens
- 21. 8000 Mg to g
- 22. 35 mg to g
- 23. 9415 m² to Gm²
- 24. 7800 F to kF
- 25. 0.2909 Pa to µPa

- 26. 6900 m to km 27. 45.00 MΩ to Ω 28. 93 µT to T 29. 5.60 GA to A 30. 5cy to y 31. 35.6 A to mA 32. 8,948 GV to V 33. 12 km to m 34. 55 nC to C 35. 82 V to mV 36. 22,000 cG to G 37. 809,398 MN to N 38. 35 $\mu\Omega$ to Ω 39. 238 H to mH 40. 45Gg to g 41. 1892 A to kA 42. 80,233 F to mF 43. 1.329 MW to kW 44. 0.034 mi to kmi 45. 28,025,400 mN to kN 46. 560,000 cm to km
- 47. 45 MH to cH
- 48. 903 kg to g
- 49. 39 µm to m
- 50. 890 Gb to Mb

Dimensional Analysis Facts Sheet

(Do not memorize. You will receive a clean copy of this on your assessment.)

POWERS of TEN

Thousand $= 10^3$ Million = 10^6 Billion = 10^9 Trillion = 10^{12} Ouadrillion $=10^{15}$ Quintillion = 10^{18} **DISTANCE/AREA UNITS** Parsec = 1.91738×10^{13} miles Furlong = $^{1}/8$ mile $Rod^2 = 1.00000400417$ Perch Rod = 16.5 feet Rod = 25.000 linksFootball field = 100 yards Soccer field = 100 METERS Rod = 5.50 yards Fathom = 6 feet Yard = 3 feet foot = 12 inches inch = 2.54 centimeters (exactly) centimeter = 10 millimeters decimeter = 10 centimeters meter = 100 centimeters 5280 feet = 1 miledekameter or decameter= 10 meters Walking pace (avg) = 31 inches Story on a building = 3 mLight year = 9.467×10^{15} meters Barn = 10^{-28} c League = 3 miles Cubit = 20 inches 4 rods = chain $1 \text{ acre} = 4047 \text{ m}^2$ ROTATIONS 1 Revolution = 360° 2π Radians = 1 Revolution

TIME UNITS

millennium = 1,000 years century = 100 years decade = 10 years years = 365 daysday = 24 hours hour = 60 minutesminute = 60 seconds Blink of an eye 1/10 second fortnight = 14 days1 score = 20 yearsWEIGHTS and METRIC MASSES Pound = 16 ounces Ton = 2000 poundsTonne = 1000 kilograms (metric ton) Long ton = 2240 pounds Gram = 1000 milligrams Kilogram = 1000 gramsKilogram = 2.205 pounds Pound = 453.5923 grams Newton = 7.233014 Poundal Dram = 27.34375 grains Pound= 7000 grains Pound = 4.448 Newtons Poundal = 14.0980814039 gram Pennyweight = 24 grains Stone = 14 pounds Clove = $\frac{1}{2}$ Stone **VOLUME MEASUREMENTS** 1 liter = 1000 milliliters 2 liters = 67.63 ounces 1 gallon = 128 ounces1 milliliter = cm^3 1 milliliter = 20 drops2 pints = 1 quart

4 quarts = 1 gallon

peck = 2 gallons

Dimensional Analysis

Objectives 🗆

You will get a sheet like this at the beginning of almost every unit. This sheet identifies the kinds of questions and the content you will need to know for the end of unit test. Dimensional Analysis (ww04)

Students will be able to:

- 1. Create a fraction from an equality relationship.
- 2. Solve unit conversion problems involving single variables.
- 3. Solve unit conversion problems involving fractions
- 4. Solve unit conversion problems where a unit or part of the unit is raised to a power.

There is an online pretest (http://www.mrwaynesclass.com). Do not memorize the unit conversion sheet.

Refer to the "Dimensional Analysis Fact Sheet"

- 1. How many inches are there in a football field?
- 2. How many feet are there in a mile?
- 3. How many yards are there in a mile?
- 4. How many yards are there in a soccer field?
- 5. How many feet are there in a furlong?
- 6. How many paces make up a football field?
- 7. How many paces make up a furlong?
- 8. How many fathoms deep is a 20 foot deep diving well?
- 9. Every 75 feet down a scuba diver goes makes him feel like he has had a martini. How many fathoms is this?
- 10. How feet are between the first and second floor of a building (one story)?
- 11. How many parsecs make up a light year?
- 12. How many rods make up a mile?
- 13. How many centimeters are in a fathom?
- 14. How many seconds are in a year?
- 15. How many hours are in a fortnight?
- 16. The average life span a tortoise is 200 years. How many scores is this?
- 17. A housefly's life span is 3 days. How many minutes is this?
- *18. If a person blinks their eyes once every 3 minutes on the average, then how many times do they blink their eye in a day?
- 19. How many grams are in a pound?
- 20. How many poundals are in a pound?
- 21. How many pounds are in a metric ton?
- 22. A typical locomotive weighs 40,000 tons. How many drams is this?
- * 23. A typical car manufactured in 1974 weighs 4000 pounds. How many McDonald's Quarter Pounders[™] is this? If the Quarter Pounder[™] costs \$0.65 in 1974 and the car costs \$6,000, then which is cheaper the car or the car's weight in Quarter Pounders[™]?

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*24. What is the speed of a car in feet/second that is traveling at 60 miles/hour?

Dimensional Analysis

- *25. The space shuttle travels at 28,000 mph while orbiting the Earth. How far does the shuttle travel in feet in the blink of an eye?
- *26. How much time, in seconds, passes before a beam of light, traveling at 3.00 X 10⁸ meters/second travels one foot?
- *27. A stack of ten 3.5 inch diskettes is 34 millimeters high. How many diskettes does it take to make a stack 100 yards high?
- *28. A physics book is 1.5 inches thick. How many books would it take to make a stack 2 stories high?
- *29. If you earned one penny every 10 seconds of your life then how many dollars would you have after 65 years?
- **30. A 5.25 inch diskette spins around once every 0.200 seconds. The disk's diameter is 5.25 seconds. If you were an insect sitting on the edge of the diskette, then how fast would travel in mph?
 - 31. A container holds 16 ounces. What is the volume of this container in inches³?
 If the container is a glass with a diameter of 2 inches, what is its height?
 - 32. An "acre" is a measure of land that is 43,560 feet². How many square meters is this?
 How many meters on each side of a square is this?
 - 33. A car is traveling at 88 ft/sec. What is the car's speed in miles/hour?
 - 34. In a crazed neighborhood they are replacing the speed limit signs that give the speed in m/s. What would the new sign say if it were to replace a 25 mph sign?
 - 35. When the space shuttle is at its maximum orbit radius it is traveling at 28,000 mph. How many miles/second is this?
 - 36. A tennis ball leaves a racket during a serve at 29.22 fathoms/s. During a yellow flag at a race on the Indianapolis speedway the cars travel 82 mi/h. A runner travels 0.125 furlong/s. Which object is traveling the fastest?
 - 37. A swimming pool can hold 20,000 gallons of water. A pond holds 2,000,000 cm³ of water. A well holds 12,000 liters of water. Which vessel holds the most amount of water?
 - 38. A peregrine falcon can travel at 537,600 furlong/fortnight. A racecar travels at 212 ft/s. A spider can jump with a maximum velocity of 9,000,000 cm/h. Which travels the fastest? Show numbers to support your answer.
 - 39. A 2 liter bottle of Pepsi costs \$0.99. A gallon of milk costs \$1.89. A 12-ounce can of "Food Lion" cola costs \$0.20. Which fluid is the cheapest per unit?
 - 40. Which is the greatest volume; a human's 8 pints of blood, a 2 liter bottle, a gallon jug of milk, or an old car engine whose displacement is 320 in³?
 - 41. A quart has an area of 5.06 cm². How many square yards is this?
 - 42. A teaspoon of oil can cover the surface of a pond about 10,000 cubits² in size. How many square yards is this?
 - 43. A fingerprint is about 1.25 in². How many cm² is this?
 - 44. The continental United States covers about 16,000,000 miles². How squared walking paces is this?
 - 45. The walls of a room have a total area of 60 square meters. How many rolls of wallpaper will it take to cover all the walls is a single roll can cover 24 ft²?

Dimensional Analysis

Dimensional Analysis Review Practice Problems

- 50 A car tire has an area of 355 in². How man mm² is this?
- **51** Our football stadium covers 0.460 acres. How many decameters² is this?
- **52** Hurricane "Harvey" dropped 27 trillion gallons in Houston, Texas. Our "large" gym has a volume equal to 756,000 ft³. How many gyms would be needed to hold all of the water that fell in Houston?
- **53** Albemarle County is the third largest county in Virginia. It is 742 miles². How many km² is this?
- **54** An adult Ostrich can run at 0.0961 furlongs per second. How fast is this in miles per hour?
- **55** The fastest growing plant is a specific type of bamboo that grows at 8.33×10^{-9} km/s. How many in/h is this?

ANSWERS:	50) 229,000 mm ³ 51) 18.6 decameters		52) 4,770,000 gyms
	53) 1920 km ²	54) 43.2 mph	55) 2.07 in/h