

# UNIVERSITY OF DELAWARE PHYSICAL THERAPY

## Weight Training Modification Handout

### ESTABLISHING ESTIMATED MAXIMUMS

#### Core Exercises - Calculating Maximums

1. Select weight that can be completed 6 to 10 times.
2. Perform exercise with selected weight and record repetitions.
3. Find weight and repetitions on 3% rule chart. Go to corresponding MAX weight on chart and find calculated 1 repetition maximum.
4. Multiply 1 repetition maximum by percentage for program design for designated step.

#### Example

Athlete completes 8 repetitions at 125 lbs. Chart projects one repetition maximum at 155 lbs. Multiply 155 by 65% to find target weight for phase 1, step 1

#### Accessory Exercises

3 sets of 8 repetitions at weight that allows perfect technique

Table 26.1 Estimating One-Repetition Maximum

% of 1RM:	100.0	93.5	91.0	88.5	86.0	83.5	81.0	78.5	76.0	73.5
Repetitions:	1	2	3	4	5	6	7	8	9	10
Weight lifted (lb):	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	5.0	4.7	4.5	4.4	4.3	4.2	4.1	3.9	3.8	3.7
	10.0	9.4	9.1	8.9	8.6	8.4	8.2	7.9	7.6	7.4
	15.0	14.0	13.7	13.3	12.9	12.5	12.2	11.8	11.4	11.0
	20.0	18.7	18.2	17.7	17.2	16.7	16.2	15.7	15.2	14.7
	25.0	23.4	22.8	22.1	21.5	20.9	20.2	19.6	19.0	18.4
	30.0	28.1	27.3	26.6	25.8	25.1	24.3	23.6	22.8	22.1
	35.0	32.7	31.9	31.0	30.1	29.2	28.4	27.5	26.6	25.7
	40.0	37.4	36.4	35.4	34.4	33.4	32.4	31.4	30.4	29.4
	45.0	42.1	41.0	39.8	38.7	37.6	36.5	35.3	34.2	33.1
	50.0	46.8	45.5	44.3	43.0	41.8	40.5	39.3	38.0	36.8
	55.0	51.4	50.1	48.7	47.3	45.9	44.6	43.2	41.8	40.4
	60.0	56.1	54.6	53.1	51.6	50.1	48.6	47.1	45.6	44.1
	65.0	60.8	59.2	57.5	55.9	54.3	52.7	51.0	49.4	47.8
	70.0	65.5	63.7	62.0	60.2	58.5	56.7	55.0	53.2	51.5
	75.0	70.1	68.3	66.4	64.5	62.6	60.8	58.9	57.0	55.1
	80.0	74.8	72.8	70.8	68.8	66.8	64.8	62.8	60.8	58.8
	85.0	79.5	77.4	75.2	73.1	71.0	68.9	66.7	64.6	62.5
	90.0	84.2	81.9	79.7	77.4	75.2	72.9	70.7	68.4	66.2
	95.0	88.8	86.5	84.1	81.7	79.3	77.0	74.6	72.2	69.8
	100.0	93.5	91.0	88.5	86.0	83.5	81.0	78.5	76.0	73.5
	105.0	98.2	95.6	92.9	90.3	87.7	85.1	82.4	79.8	77.2
	110.0	102.9	100.1	97.4	94.6	91.9	89.1	86.4	83.6	80.9
	115.0	107.5	104.7	101.8	98.9	96.0	93.2	90.3	87.4	84.5
	120.0	112.2	109.2	106.2	103.2	100.2	97.2	94.2	91.2	88.2
	125.0	116.9	113.8	110.6	107.5	104.4	101.3	98.1	95.0	91.9
	130.0	121.6	118.3	115.1	111.8	108.6	105.3	102.1	98.8	95.6
	135.0	126.2	122.9	119.5	116.1	112.7	109.4	106.0	102.6	99.2
	140.0	130.9	127.4	123.9	120.4	116.9	113.4	109.9	106.4	102.9
	145.0	135.6	132.0	128.3	124.7	121.1	117.5	113.8	110.2	106.6
	150.0	140.3	136.5	132.8	129.0	125.3	121.5	117.8	114.0	110.3
	155.0	144.9	141.1	137.2	133.3	129.4	125.6	121.7	117.8	113.9
	160.0	149.6	145.6	141.6	137.6	133.6	129.6	125.6	121.6	117.6
	165.0	154.3	150.2	146.0	141.9	137.8	133.7	129.5	125.4	121.3
	170.0	159.0	154.7	150.5	146.2	142.0	137.7	133.5	129.2	125.0
	175.0	163.6	159.3	154.9	150.5	146.1	141.8	137.4	133.0	128.6
	180.0	168.3	163.8	159.3	154.8	150.3	145.8	141.3	136.8	132.3
	185.0	173.0	168.4	163.7	159.1	154.5	149.9	145.2	140.6	136.0
	190.0	177.7	172.9	168.2	163.4	158.7	153.9	149.2	144.4	139.7
	195.0	182.3	177.5	172.6	167.7	162.8	158.0	153.1	148.2	143.3

(continued)

Table 26.1 (continued)

% of 1RM:	100.0	93.5	91.0	88.5	86.0	83.5	81.0	78.5	76.0	73.5
Repetitions:	1	2	3	4	5	6	7	8	9	10
Weight lifted (lb): 200.0	200.0	187.0	182.0	177.0	172.0	167.0	162.0	157.0	152.0	147.0
205.0	205.0	191.7	186.6	181.4	176.3	171.2	166.1	160.9	155.8	150.7
210.0	210.0	196.4	191.1	185.9	180.6	175.4	170.1	164.9	159.6	154.4
215.0	215.0	201.0	195.7	190.3	184.9	179.5	174.2	168.8	163.4	158.0
220.0	220.0	205.7	200.2	194.7	189.2	183.7	178.2	182.7	167.2	161.7
225.0	225.0	210.4	204.8	199.1	193.5	187.9	182.3	176.6	171.0	165.4
230.0	230.0	215.1	209.3	203.6	197.8	192.1	186.3	180.6	174.8	169.1
235.0	235.0	219.7	213.9	208.0	202.1	196.2	190.4	184.5	178.6	172.7
240.0	240.0	224.4	218.4	212.4	206.4	200.4	194.4	188.4	182.4	176.4
245.0	245.0	229.1	223.0	216.8	210.7	204.6	198.5	192.3	186.2	180.1
250.0	250.0	233.8	227.5	221.3	215.0	208.8	202.5	196.3	190.0	183.8
255.0	255.0	238.4	232.1	225.7	219.3	212.9	206.6	200.2	193.8	187.4
260.0	260.0	243.1	236.6	230.1	223.6	217.1	210.6	204.1	197.6	191.2
265.0	265.0	247.8	241.2	234.5	227.9	221.3	214.7	208.1	201.4	194.8
270.0	270.0	252.5	245.7	239.0	232.2	225.5	218.7	212.0	205.2	198.5
275.0	275.0	257.1	250.3	243.4	236.5	229.6	222.8	215.9	209.0	202.1
280.0	280.0	261.8	254.8	247.8	240.8	233.8	226.8	219.8	212.8	205.8
285.0	285.0	266.5	259.4	252.2	245.1	238.0	230.9	223.7	216.6	209.5
290.0	290.0	271.2	263.9	256.7	249.4	242.5	234.9	227.7	220.4	213.2
295.0	295.0	275.9	268.5	261.1	253.7	246.3	239.0	231.6	224.2	216.8
300.0	300.0	280.5	273.0	265.5	258.0	250.5	243.0	235.5	228.0	220.5
305.0	305.0	285.2	277.6	269.9	262.3	254.7	247.1	239.4	231.8	224.2
310.0	310.0	289.9	282.1	274.4	266.6	258.9	251.1	243.4	235.6	227.9
315.0	315.0	294.5	286.7	278.8	270.9	263.0	255.2	247.3	239.4	231.5
320.0	320.0	299.2	291.2	283.2	275.2	267.2	259.2	251.2	243.2	235.2
325.0	325.0	303.9	295.8	287.6	279.5	271.4	263.3	255.1	247.0	238.9
330.0	330.0	308.6	300.3	292.1	283.8	275.9	267.3	259.1	250.8	242.6
335.0	335.0	313.2	304.9	296.5	288.1	279.7	271.4	263.0	254.6	246.2
340.0	340.0	317.9	309.4	300.9	292.4	283.9	275.4	266.9	258.4	249.9
345.0	345.0	322.6	314.0	305.3	296.7	288.1	279.5	270.8	262.2	253.6
350.0	350.0	327.3	318.5	309.8	301.0	292.3	283.6	274.8	266.0	257.3
355.0	355.0	331.9	323.1	314.2	305.3	296.4	287.6	278.7	269.8	260.9
360.0	360.0	336.6	327.6	318.6	309.6	300.6	291.6	282.6	273.6	264.6
365.0	365.0	341.3	332.2	323.0	313.9	304.8	295.7	286.5	277.4	268.3
370.0	370.0	346.0	336.7	327.5	318.2	309.0	299.7	290.5	281.2	272.0
375.0	375.0	350.6	341.3	331.9	322.5	313.1	303.8	294.4	285.0	275.6
380.0	380.0	355.3	345.8	336.3	326.8	317.3	307.8	298.3	288.8	279.3
385.0	385.0	360.0	350.4	340.7	331.1	321.5	311.9	302.2	292.6	283.0
390.0	390.0	364.7	354.9	345.2	335.4	325.7	315.9	306.2	296.4	286.7
395.0	395.0	369.3	359.5	349.6	339.7	329.8	320.0	310.1	300.2	290.3

(continued)

Table 26.1 (continued)

% of 1RM:	100.0	93.5	91.0	88.5	86.0	83.5	81.0	78.5	76.0	73.5
Repetitions:	1	2	3	4	5	6	7	8	9	10
Weight lifted (lb):	400.0	374.0	364.0	354.0	344.0	334.0	324.0	314.0	304.0	294.0
	405.0	378.7	368.6	358.4	348.3	338.2	328.1	317.9	307.8	297.7
	410.0	383.4	373.1	362.9	352.6	342.4	332.1	321.9	311.6	301.4
	415.0	388.0	377.7	367.3	356.9	346.5	336.2	325.8	315.4	305.0
	420.0	392.7	382.2	371.7	361.2	350.7	340.2	329.7	319.2	308.7
	425.0	397.4	386.8	376.1	365.5	354.9	344.3	333.6	323.0	312.4
	430.0	402.1	391.3	380.6	369.8	359.1	348.3	337.6	326.8	316.1
	435.0	406.7	395.9	385.0	374.1	363.2	352.4	341.5	330.6	319.7
	440.0	411.4	400.4	389.4	378.4	367.4	356.4	345.4	334.4	323.4
	445.0	416.1	405.0	393.8	382.7	371.6	360.5	349.3	338.2	327.1
	450.0	420.8	409.5	398.3	387.0	375.8	364.5	353.3	342.0	330.8
	455.0	425.4	414.1	402.7	391.3	379.9	368.6	357.2	345.8	334.4

### Example for Estimating the 1RM

To estimate 1RM from a 10RM test-measured value, have the athlete perform a set of 10 repetitions with a light weight. Depending on the ease with which this is completed, add additional weight and have the athlete perform another set of 10 repetitions. A rest of 2 to 4 min should be allowed between trials to insure adequate recuperation. Continue the process until a weight allowing *only* 10 repetitions is discovered. An experienced instructor can aid the athlete by supervising the process so that the 10RM value can be discovered in fewer than five trials. The athlete can then consult a table (such as Table 26.1) and find in the 10-repetition column the weight he or she achieved and then find the weight on the same line in the 1RM column to estimate his or her 1RM. For example, 10 repetitions with 330 lb yields in Table 26.1 a 1RM of 440 lb. Values may vary somewhat from table to table.

These tables are controversial as to their accuracy for different athletes and different lifts (7); they seem to be more accurate for free-weight and multiple-joint exercises than for machine exercises. They are intended to provide a general guide until the trainee has developed the neural and proprioceptive attributes that would make testing at low RMs (1RM-5RM) safe and effective (5,10,17). For example, after 2 weeks of introductory training (2 to 6 sessions), an RM could be established with a weight that allows for, say, 10 repetitions. Tables can be consulted to estimate the 1RM for further load assignment over the coming weeks. After 6 weeks (12-18 training sessions), a 1RM to 5RM test can be conducted. Strength-and-power athletes may benefit from

training with percentages of an established 1RM; other athletes may equally benefit from training with percentages of a 5RM or 10RM. The results obtained from lower RM testing are generally more accurate when an athlete has been training with low-RM resistances for a few training sessions prior to testing.

Excessive trials (sets) may fatigue the trainee to the point where an accurate estimate cannot be made. Some exercises, such as power cleans and snatches, do not lend themselves well to RM testing above five repetitions, owing to rapid deterioration of technique with fatigue. However, lower RM determinations can be made once the athlete has sufficient technique and experience. A very simple alternate method for estimating a low RM has been proposed (5); this method utilizes an RM continuum (Figure 26.1). Through trial and error, the athlete determines and utilizes weights at a variety of RMs to train with, depending on the phase or period of the training cycle. For example, early in a training cycle, weights at 10 RM to 12RM would be determined and utilized. As more repetitions are able to be performed with the 10RM to 12RM weight, the athlete adds weight. As the cycle progresses, the trainee adds intensity (resistance) as he or she moves through the RM continuum from high to low RMs.

Determining weights at various RMs is easier with machines than with free-weight equipment. This is due to the motor learning factor, which has more of an influence with free weight apparatus; balance and coordination are not critical with machines. Most athletes are able to accurately find their 5RM to 10RM weights after a week or so of machine training. Many weeks may be needed to accurately and safely determine the