S5 Music Practice Paper with Answers

Music · S5 · Data-response

S5 music practice paper with answers on acoustics, cents, scales, transposition, tempo, note values, triplets, instrument upkeep and concert box office. Full marking scheme.

Part 1: Acoustics, frequency and cents

Data A (simulated): the international standard pitch A4 is 440 Hz; a perfect fifth has a frequency ratio of 3:2; in equal temperament one semitone equals 100 cents. Study the data and answer all parts.

#	Question	Answer and marking notes
1	Calculate the frequency of A5, one octave above A4.	Answer: an octave has a frequency ratio of 2:1, so A5 = 440 x 2 = 880 Hz.
2	Calculate the frequency of E5, a perfect fifth above A4.	Answer: a perfect fifth has a ratio of 3:2, so E5 = 440 x 3 / 2 = 660 Hz.
3	A#4 has a frequency of 466.16 Hz. Using cents = 1200 x log2(f2 / f1), calculate the interval in cents between A4 and A#4, to one decimal place.	Answer: cents = 1200 x log2(466.16 / 440) = 1200 x 0.08332 = 100.0 cents, which is about one equal-tempered semitone (100 cents).
4	During tuning a player produces A at 452 Hz, which is above the standard A4 (440 Hz). (1) Calculate the difference in cents, to one decimal place. (2) State whether this lies within the plus or minus 5 cents normally accepted by an ensemble, and explain. (3) Suggest one practical way to correct the tuning.	Answer: (1) cents = 1200 x log2(452 / 440) = 1200 x 0.03882 = 46.6 cents, so the note is 46.6 cents sharp; (2) this is outside the plus or minus 5 cents range, so beating against the other instruments is audible and the harmony becomes unstable; (3) string players can slacken the string slightly and wind players can pull the tube out a little to lower the pitch, then check with an electronic tuner to within 2 cents of 440 Hz.

Part 2: Scale structure and transposition

Data B: a major scale is built on the pattern whole, whole, half, whole, whole, whole, half; a just major third has a frequency ratio of 5:4; each equal-tempered semitone is 100 cents.

#	Question	Answer and marking notes
5	State the interval pattern of a major scale and identify the two semitone steps in the C major scale.	Answer: whole, whole, half, whole, whole, whole, half; in C major the semitones are E-F and B-C, and the rest are whole tones.
6	Starting on D, write the eight notes of the D major scale and state how many sharps are in its key signature.	Answer: D, E, F#, G, A, B, C#, D; the key signature has two sharps (F# and C#).
7	A piece in C major is performed two semitones higher. Name the new key and state which note the original G moves to.	Answer: two semitones higher gives D major; G (the 5th degree of C major) moves to A (the 5th degree of D major), so the scale-degree relations are unchanged.

#	Question	Answer and marking notes
8	Using the frequency ratio, calculate the size in cents of a just major third (5:4) to the nearest cent, compare it with the equal-tempered major third (400 cents), and explain the audible effect of the difference.	Answer: just major third = 1200 x log2(5 / 4) = 1200 x 0.32193 = 386 cents, which is 13.7 cents narrower than the equal-tempered 400 cents. Because the just ratio is a simple integer ratio, beating is minimal and the chord sounds more blended and stable; equal temperament keeps every semitone identical so that free modulation is possible, at the cost of a slightly wide third and a less pure harmony.

Part 3: Metre, tempo and performance time

Data C: a piece is in 4/4 time with a tempo marking of quarter note = 96 (that is 96 quarter-note beats per minute); the piece has 32 bars in total.

#	Question	Answer and marking notes
9	Calculate the duration of one beat (one quarter note) in seconds, to three decimal places.	Answer: one beat = 60 / 96 = 0.625 s.
10	Calculate the playing time of one bar in seconds, to three decimal places.	Answer: a bar has 4 beats, so 4 x 0.625 = 2.500 s.
11	Calculate the total playing time of the piece in seconds and in minutes and seconds.	Answer: total beats = 32 x 4 = 128; total time = 128 x 0.625 = 80.0 s, that is 1 minute 20 seconds.
12	If the conductor changes the tempo to quarter note = 84, calculate the new total time and the difference from the original (each to one decimal place), and explain how this affects the concert running order.	Answer: new beat = 60 / 84 = 0.7143 s; new total = 128 x 0.7143 = 91.4 s, which is 91.4 - 80.0 = 11.4 s longer. Effect: the running order must allow about 11.4 s more, and the ensemble has to rehearse the new tempo with the accompanist so that the next item is not delayed.

Part 4: Dotted notes and triplets

Data D: a dotted note lasts 1.5 times its undotted value; a triplet divides one beat into three equal parts; another piece is in 6/8 time at dotted quarter note = 100 (that is 100 dotted quarter beats per minute).

#	Question	Answer and marking notes
13	Calculate the value of a dotted minim (dotted half note) in quarter-note beats.	Answer: a minim is 2 beats and the dot adds 1 beat, so 2 x 1.5 = 3 beats.
14	In one 4/4 bar, give two different combinations of notes that exactly fill the bar (name each note and its quantity).	Answer (any two): four quarter notes; one minim plus two quarter notes; eight eighth notes; one dotted minim plus one quarter note (4 beats in total).
15	In 6/8 time each bar contains two dotted quarter beats. Calculate the duration of one beat, of one bar, and of 16 bars (in seconds, to two decimal places).	Answer: one beat = 60 / 100 = 0.6 s; one bar = 2 x 0.6 = 1.2 s; 16 bars = 16 x 1.2 = 19.2 s.

#	Question	Answer and marking notes
16	In a passage at quarter note = 90, calculate the duration of each note of a triplet within one beat (to four decimal places) and state the most common rhythmic fault when playing triplets.	Answer: one beat = 60 / 90 = 0.6667 s; each triplet note = 0.6667 / 3 = 0.2222 s. The most common fault is uneven length: the first two notes are played like a dotted eighth plus a sixteenth, or the first note is accented too strongly, so the triplet loses its even flow.

Part 5: Practice time and instrument upkeep costs

Data E (simulated): an S5 student practises the piano 5 days a week for 45 minutes a day, and the violin 2 days a week for 30 minutes a day. The piano is tuned 2 times a year at 680 dollars each time; the violin strings are replaced once a year at 420 dollars.

#	Question	Answer and marking notes
17	Calculate the student total practice time per week in minutes and in hours and minutes.	Answer: piano 5 x 45 = 225 minutes; violin 2 x 30 = 60 minutes; total 225 + 60 = 285 minutes, that is 4 hours 45 minutes.
18	A term lasts 12 weeks. With the same routine, calculate the total practice hours for the term, to one decimal place.	Answer: 285 x 12 = 3420 minutes; 3420 / 60 = 57.0 hours.
19	Assuming the upkeep routine stays the same for 5 years, calculate the total upkeep cost over those 5 years.	Answer: piano 680 x 2 = 1360 dollars a year plus 420 dollars for strings, that is 1780 dollars a year; over 5 years = 5 x 1780 = 8900 dollars.
20	(1) Calculate the present average daily practice time in minutes, to one decimal place. (2) To raise the average to 60 minutes a day, how many extra minutes a week are needed? (3) Calculate the required percentage increase to one decimal place and comment on whether it is realistic.	Answer: (1) 285 / 7 = 40.7 minutes; (2) the target is 60 x 7 = 420 minutes a week, so 420 - 285 = 135 extra minutes are needed; (3) the increase is 135 / 285 x 100% = 47.4%, about 2 hours 15 minutes more a week, which means lengthening some 45-minute days to 70 minutes or adding one more day; it is realistic if built up gradually, but the load must be balanced against school work to avoid strain injuries.

Part 6: Concert costs and box office

Data F (simulated): a school concert costs 12,000 dollars for the venue, 8 players at 800 dollars each, 6,500 dollars for sound and lighting, and 3,500 dollars for promotion; the venue holds 400 seats.

#	Question	Answer and marking notes
21	Calculate the total cost of the concert.	Answer: 12,000 + 8 x 800 + 6,500 + 3,500 = 12,000 + 6,400 + 6,500 + 3,500 = 28,400 dollars.
22	If every seat is sold, calculate the break-even ticket price to the nearest dollar.	Answer: 28,400 / 400 = 71 dollars.

#	Question	Answer and marking notes
23	The ticket price is set at 120 dollars and 320 tickets are sold. Calculate the ticket revenue, the profit and the seat occupancy rate (to the nearest whole percent).	Answer: revenue = 120 x 320 = 38,400 dollars; profit = 38,400 - 28,400 = 10,000 dollars; occupancy = 320 / 400 x 100% = 80%.
24	If the price is raised to 150 dollars and only 250 tickets are sold, (1) calculate the profit; (2) state how much it differs from the previous part; (3) suggest one practical way to raise revenue.	Answer: (1) revenue = 150 x 250 = 37,500 dollars, so profit = 37,500 - 28,400 = 9,100 dollars; (2) 10,000 - 9,100 = 900 dollars less than at a price of 120 dollars; (3) offer tiered prices such as student and senior concessions and strengthen in-school promotion and advance sales, trading a lower price for higher occupancy so that total revenue rises.